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A monthly publication of the Geological Survey
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

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08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

SUMMARY OF CLIMATIC CONDITIONS IN NATAL.
Cedara Research Inst., Pietermaritzburg (South Africa).
Report N2/1982, January 1982. 60 p.

Descriptors: *Meteorologic data collections, *Climatic data, *Precipitation, *Temperature, *Evaporation, Standard deviation, Natal, South Africa, Wind velocity, Rainfall, Elevation, Solar radiation, Air temperature.

Tables show the climatic conditions in Natal, South Africa. Seven climatic elements for about 60 stations are included: maximum temperature, minimum temperature, average temperature, average rainfall, average evaporation, average wind velocity, and average sunshine. The importance of standard deviation is emphasized.
W86-00321

RETURN PERIOD ANALYSIS WITH SLIDING POLYNOMIALS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
W. M. Snyder, and A. W. Thomas.
Presented at the 1983 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 83-4533, December 13-16, 1983, Chicago, IL. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Sliding polynomials, *Graphical methods, *Probability distributions, *Mathematical studies, *Statistical methods, *Mathematical models, Comparison studies, *Return flow, Models, Mathematical equations, Computer models, Statistical models, Statistical analysis, Model studies, Prediction, *Flood forecasting, Graphical analysis.

A method of return-period analysis is presented which does not require assumption of a probability function or of plotting positions. Piece-wise sliding polynomials are used to smooth historical samples by least squares. Imposition of a boundary control produces a restrained fitting which suppresses much sample-to-sample variability for extreme values. Variability of predictions for the 1-in-100 event is only one-fifth the variability using the graphical method. The method can be used to estimate uncertainty of prediction for any chosen level of risk. (Author's abstract)
W86-00374

RETURN PERIOD ANALYSIS OF MINIMUM EVENTS USING SLIDING POLYNOMIALS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. Thomas, and W. M. Snyder.
Presented at the 1983 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 83-4534, December 13-16, 1983, Chicago, IL. 15 p. 7 Fig, 9 Ref.

Descriptors: *Model studies, *Simulation analysis, *Stochastic process, *Sliding polynomials, *Mathematical studies, *Mathematical models, *Probability distribution, Models, Probabilistic process, Planning, Temperature, Rainfall, Statistical methods, Streamflow, *Return period.

A form-free method for determining return periods of minimum values of stochastic events has been developed. Such minima represent expectancies of limited availability of natural resources and their analyses can aid planners and managers of agricultural production systems. The method for return-period analysis of minimum events, like that for maximum events, used form-free sliding polynomials as smoothing operators, thus reducing the bias produced by assuming some particular probability function as a smoothing operator. Studies of minimum rainfall, streamflow and temperatures showed flexibility in shaping the smoothing curves while maintaining faithful adherence to the sample data. Simulations were used to compute and expected range of future events associated with any level of risk selected by the user. Simulations of long-period and short-period possible future minima for different return periods showed that the uncertainties faced by planners and managers are highly conditioned by unique features of particular data sets and by the length of the return period over which costs and benefits might be averaged.
W86-00375

TESTING THE CLIMATIC REPRESENTATIVENESS OF SHORT-PERIOD RECORDS THROUGH SIMULATION,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. Thomas, and W. M. Snyder.
To be presented at: the 1984 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 84-2501, December 11-14, 1984, New Orleans, LA., 16 p. 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Mathematical models, *Model studies, *Rainfall, *Stochastic process, *Sliding polynomials, *Probabilistic process, *Statistical models, *Climatology, Models, Mathematical studies, Planning, Probability distribution, Statistical methods, Statistical analysis, Simulation analysis.

A form-free method was devised and tested for evaluating the climatic representativeness of short-period records. The method is similar to recently developed stochastic analyses of maximum and minimum events in that sample probabilities are least-squares derivation of arcs of the four-point sliding polynomials. Both large and small events were analyzed as well as averages or totals. In addition, a procedure was devised to handle the occurrences of numerous days with no rainfall with an adaptation of the virtual and real approach based on smoothing with sliding polynomials. The stochastic characteristics of long term rainfall record established a probabilistic scale against which to test events during short-period research. This probability scale determined a standard from which judgemental assessment to representativeness can be made. Planners must consider the representativeness of data in order to assess agricultural practices and programs.
W86-00376

SOIL-PLANT-WATER MODEL WITH A CASE STUDY IN A FORESTED CATCHMENT,
Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
For primary bibliographic entry see Field 2I.
W86-00595

2B. Precipitation

COMBINED HYDROMETEOR DISTRIBUTIONS FROM THREE PMS PROBES,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W86-00308

TESTING THE CLIMATIC REPRESENTATIVENESS OF SHORT-PERIOD RECORDS THROUGH SIMULATION,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 2A.
W86-00376

GROSSVERSUCH IV: 'EXTENDED AREA' EFFECTS ON RAINFALL,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
For primary bibliographic entry see Field 3B.
W86-00424

OBSERVATION ON MICROPHYSICAL PROCESSES IN THE STRATIFORM PRECIPITATIONS INCLUDING MELTING LAYERS AT MT. FUJI,
Nagoya Univ. (Japan). Water Research Inst.
T. Yokoyama, H. Tanaka, K. Akaeda, T. Ohtani, and N. Yoshizawa.
Journal of the Meteorological Society of Japan, Vol. 63, No. 1, p 100-111, February, 1985. 9 Fig, 1 Tab, 18 Ref.

Descriptors: *Mt. Fuji, *Japan, *Precipitation, *Snow, *Rain, Stratiform, Micrometeorology.

In order to investigate microphysical processes in stratiform precipitations including melting layers, size distributions of the precipitation particles were measured by filter paper methods at three observational stations with different altitude on Mt. Fuji, Japan. Where snowflakes form, above or at the upper edge of the melting layer, small sized particles smaller than 0.1 cm in diameter were predominant in number and volume. Where snowflakes melt and refreeze, forming sleet, and in the melting layer, large sized particles larger than 0.2 cm increase in number and predominate in volume. Small sized particles decrease. Where raindrops form, below the melting layer, medium sized particles between 0.1 and 0.2 cm predominate in volume. The vertical change of the size distribution of raindrops was insignificant far below the melting layer. (Baker-IVI)
W86-00425

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS, PART I: COLLECTION EFFICIENCY OF UNCHARGED SNOW CRYSTALS FOR MICRON AND SUBMICRON PARTICLES,
Hokkaido Univ., Sapporo (Japan). Div. of Environmental Structure.
M. Murakami, K. Kikuchi, and C. Magono.
Journal of the Meteorological Society of Japan, Vol. 63, No. 1, p 119-129, February, 1985. 11 Fig, 17 Ref.

Descriptors: *Aerosols, *Snow, *Precipitation, Micrometeorology, Clouds, Crystals, Collection efficiency.

In order to verify the collection efficiencies which were observed in earlier studies and to investigate some effects on the collection efficiency, experiments on the collection of aerosol particles (0.1 micro-m $<$ dp $<$ 6 micro-m) by uncharged natural snow crystals were carried out in an aerosol chamber. The collection efficiency of the uncharged snow crystals decreased with the decreasing aerosol size from 6 micro-m to 0.2 micro-m in diameter. The collect efficiency attained the minimum value at around 0.2 micro-m, and increased with the decreasing aerosol size from 0.2 micro-m to 0.1 micro-m. As for the aerosol particles of 0.2 micro-m to 6 micro-m in diameter, it was deduced that the interception was the main scavenging mechanism. The difference between the collection efficiencies of the rimed and unrimed snow crystals was small in the present experiments. This means that the aerodynamic effects were small. The difference of one order of magnitude between the collection efficiencies of the rimed and unrimed snow crystals, obtained in earlier studies, was attributed to the in cloud scavenging effect. The collection efficiency obtained in the present experiments was almost coincident with that of the unrimed snow crystals obtained from previous field observations. The observational values of particle averaged collection efficiency previously obtained were verified by the collection efficiency, which was given as a function of particle size, obtained in the present studies. (Baker-IVI)
W86-00426

BUDGET OF NITROGEN DISSOLVED IN RAINFALL DURING ITS PASSING THROUGH THE CROWN CANOPY IN FOREST ECOSYSTEMS,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
A. Stachurski, and J. R. Zimka.
Ekologia Polska, Vol. 32, No. 2, p 191-218, 1984. 11 Fig, 7 Tab, 17 Ref.

Descriptors: *Throughfall, *Canopy, *Nitrogen, *Rainfall, *Forests, Fauna, Leaching, Aerosols, Ecosystems, Nutrients, Poland.

The effects of hydrologic and biotic factors on the budget of nitrogen in throughfall were investigated. A new type of rain trap with a double filter system was set up in open spaces and beneath the canopy. During the growing season nine forest ecosystems representing five physiosociological units were analyzed in the Kampinos National Park and in Masurian forests in Poland. The input of nitrogen in water solutions from the atmosphere ranged from 3.8 kg/ha/growing season to as much as 21.8 kg/ha/growing season. The rate of nitrogen input was also variable. The budget of dissolved nitrogen in the forest ecosystems was positive (Kampinos) or strongly negative (Masuris), but no consistent differences could be found related to a particular species structure of the stands. Using the multiple regression method, the effect was analyzed of four factors on the nitrogen budget discussed: amount of rainfall intercepted by the canopy, amount of water in the throughfall phytophage activity measured by biomass, and the quantity of nitrogen input with water solutions from the atmosphere. Phytophage activity caused an enrichment of the throughfall with nitrogen, while dissolved nitrogen input from the atmosphere was absorbed by the canopy layer. Nearly 80% of the nitrogen input from the atmosphere was absorbed by the canopy. The passing of nitrogen in water solutions through the canopy is not static in nature, nor is it controlled by hydrologic factors. It is a fully dynamic process controlled by biotic factors, and its final result is determined by the quantitative predominance of either factor, the effect of which is opposite to that of the other: nitrogen absorption by the canopy, and phytophage activity. (Baker-IVI)
W86-00437

SIMULATION OF CORRELATED RAINFALL AMOUNT AND DURATION DATA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
K. B. Rojiani, K. A. Tarbell, V. O. Shanholtz, and F. E. Woeste.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 129-132, January/February, 1985. 5 Fig, 2 Tab, 6 Ref. OSM grant G1115514.

Descriptors: *Rainfall, *Simulation, Distribution, Duration, Least squares method.

Rainfall amount and storm duration are two important variables in the modeling and simulation of erosion loss and sediment yield. Because rainfall amount and storm duration are often correlated, a procedure for simulating this correlation is desirable. A technique is presented for generating compatible sets of rainfall amount and storm duration values. The method is based on regression analysis and requires a knowledge of the distribution of one of the individual variables and the correlation between the two variables, but not the joint probability distribution. Random values generated from the distribution of storm duration are used to predict the associated random values of the rainfall amount. Using a 28 year data base from Blacksburg, Virginia, distributions for rainfall amount and storm duration were obtained. Using the model, compatible values of rainfall amount and storm duration were generated using the regression model. A comparison of distribution form and distribution parameters for the original and simulated data indicated that the simulated data mimicked the original data. The technique provides a useful and practical method for generating correlated rainfall data. (Baker-IVI)
W86-00492

ESTIMATING SOIL DETACHMENT CAUSED BY RAINDROP IMPACT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. E. Gilley, and S. C. Finkner.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 140-146, January/February, 1985. 2 Fig, 4 Tab, 22 Ref.

Descriptors: *Rain, *Impact, *Velocity, *Soil detachment, Kinetic energy, Mathematical equations, Soil erosion.

This study was an attempt to evaluate, using existing data, the performance of several soil detachment relations; identify a detachment equation for use with raindrops impacting at terminal velocity and determine the rainfall detachment factor as a function of rainfall itensity for natural rainfall conditions. The rainfall factors which were examined included: kinetic energy times unit of drop area, kinetic energy times unit of drop circumference, kinetic energy, kinetic energy per unit of drop circumference, kinetic energy per unit of drop area, momemtum times unit of drop area, momentum times unit of drop circumference, momentum, momentum per unit of drop circumference and momentum per unit of drop area. Dimensionless equations incorporating each of these parameters were derived. For the selected rainfall factors, the only difference between the dimensionless equations was found to exist in the exponent values to which the relative raindrop diameter and velocity variables were raised. Use of kinetic energy times unit of drop circumference for determining soil detachment for individual soils was also examined. The reliability of estimates obtained using this factor varied significantly between soil materials. For the case of raindrops falling at terminal velocity, impact velocity was written as a function of raindrop diameter and, therefore, eliminated in the detachment equation. From information available in the literature on the drop size distribution of natural rainfall at varying rainfall intersities, an equation relating soil detachment to rainfall intensity was obtained. (Baker-IVI)
W86-00494

DROP SIZE DISTRIBUTION MEASUREMENT PROBLEMS USING A LASER UNIT,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 7B.
W86-00502

2D. Evaporation and Transpiration

TABLES FOR ESTIMATING DAILY EVAPORATION RATES OVER CROPS USING TEMPERATURE, ELEVATIONAL AND LATITUDINAL DATA ONLY,
Cedara Research Inst., Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 2I.
W86-00313

TRANSPIRATION EFFICIENCY IN RELATION TO NUTRIENT STATUS,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
G. K. Walker, and J. E. Richards.
Agronomy Journal, Vol. 77, No. 2, p 263-269, March-April, 1984. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Alfalfa, *Corn, *Transpiration, *Nutrients, Potassium, Biomass, Water use, Evapotranspiration, Fertilizers.

Many experiments have shown a linear relationship between plant biomass and water use. Despite this, it is thought that general nutrient deficiency lowers transpiration efficiency. Since little attention has been given to the effects of specific nutrients, a study was designed to examine the effects of a single nutrient, K, on the transpiration efficiency of alfalfa (Medicago sativa L.). In addition, maize (Zea mays L.) biomass and water-use data obtained in 1911 by Montgomery and Kiesselbach, at a range of nutrient levels, were reanalyzed to further assess nutrient effects on transpiration efficiency. In a greenhouse study, 'Banner' alfalfa was grown, in pots, in a range of soils varying widely in K status but otherwise adequately fertilized. A sand mulch was used to minimize evaporation from the pots. Evapotranspiration (determined by weighing) and biomass data were collected over seven regrowth cycles. At every harvest there was a wide range in tissue K status, but only at harvest four did transpiration efficiency appear reduced by restricted K supply. Biomass and evapotranspiration remained well correlated and linearly related for every harvest, despite the increasing occurrence of severe K deficiency as the experiment progressed. Transpiration efficiency did fall substantially for the last two harvests, possibly in response to the lower (winter) light regime under which those harvests were made. Although not applicable to specific nutrient, Montgomery and Kiesselbach's maize data yield similar results, and do not suggest the nutrient deficiency leads to lower transpiration efficiency. (Author's abstract)
W86-00464

RELATIONSHIPS BETWEEN CROP WATER STRESS INDEX AND ALFALFA YIELD AND EVAPOTRANSPIRATION,
New Mexico Agricultural Experiment Station, Las Cruces.
For primary bibliographic entry see Field 2I.
W86-00468

TIME SERIES ANALYSIS OF DAILY SOLAR RADIATION AND AIR TEMPERATURE MEASUREMENTS FOR USE IN COMPUTING POTENTIAL EVAPOTRANSPIRATION,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
N. Persaud, and A. C. Chang.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 462-470, March/April, 1985. 7 Fig, 7 Tab, 10 Ref.

Descriptors: *Time series analysis, *Air temperature, *Evapotranspiration, *Solar radiation, Evaporation, Transpiration, Temperature effects.

Time series analysis techniques were used to study the bivariate relationships between daily maximum, minimum, or average air temperatures and solar radiation. The data utilized in the analysis consisted of 1096 daily observations of the four variables taken near Arvin in the San Joaquin Valley, California for the years 1959-1961. The annual cycle and the semi-annual cycle contributed the most to the variance of the temperature series. Spectral analysis in conjunction with Box-Jenkins transfer function techniques proved useful to estimate the daily solar radiation with daily temperature measurements as the input data. The potential evapotranspiration (PET) values computed from the estimated solar radiation data agreed well with those obtained from computation using measured daily solar radiation. (Baker-IVI)
W86-00469

EFFECT OF POTENTIAL EVAPOTRANSPIRATION ESTIMATES ON CROP MODEL SIMULATIONS,
Agricultural Research Service, Temple, TX.
W. A. Dugas, and C. G. Ainsworth.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 471-475, March/April, 1985. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Evapotranspiration, *Mathematical equations, *Model studies, Crop yield, Wheat, Corn, Sorghum, Penman equations, Estimating equations, Seasonal variation, Simulation.

Crop growth simulation models integrate the effects of meteorological, soil, and management variables to simulate plant growth and development. Penman and Priestley-Taylor (PT) equations for estimating potential evapotranspiration (PET) were used in sorghum, wheat, and corn crop models. All models had been developed using the PT equation. Substitution of the Penman equation significantly reduced simulated yields and affected other water-related model outputs, but had little effect upon phenology. Effects were generally greatest at locations where advection is greater. During the growing season at some locations, advective energy may significantly affect PET rates and one would assume that a water balance using the Penman equation for estimating PET would be more accurate. The effects were a direct result of changing PET and, thus, soil water status. This

change in status altered model processes such as potential photosynthetic, root growth, grain filling, and leaf growth rates. These differences were greatest late in the season. Other model outputs also may have been affected. Using a modification of the PT PET equation, such as changing the alpha value or adjusting for advective effects as a function of other meteorological elements, likely would produce similar kinds of results. Users of models, therefore, need to be aware of the effects changing the PET equation can have on model outputs. (Baker-IVI)
W86-00470

TRANSPIRATION RATE AND WATER USE EFFICIENCY OF SOYBEAN LEAVES ADAPTED TO DIFFERENT CO2 ENVIRONMENTS,
Florida Univ., Gainesville. Dept. of Agronomy.
R. Valle, J. W. Mishoe, J. W. Jones, and L. H. Allen, Jr.
Crop Science, Vol. 25, No. 3, p 477-482, May/June, 1985. 5 Fig, 3 Ta, 19 Ref.

Descriptors: *Carbon dioxide, *Leaves, *Transpiration, *Water use efficiency, Water loss, Water potentials, Wind, Soybeans, Leaf temperature, Photosynthesis, Wind.

The effects of carbon dioxide on leaf transpiration, leaf resistance, leaf temperature, and water use efficiency (WUE) in soybean plants adapted to different CO2 environments were investigated. During the podfill period, the transpiration rate (TR) of soybean leaflets measured in leaf cuvettes from plants grown at 660 and at 330 micromol CO2/mol were not significantly different. Leaf resistance and leaf temperature were higher in leaflets adapted to high CO2 than those adapted to ambient CO2 levels. The similarity in leaf TR was probably the result of partial compensation due to increases in vapor pressure gradient (VPG) that canceled effects resulting from increases in leaf resistance caused by high CO2. The two-fold increase in WUE of leaflets adapted to 660 micromol CO2/mol was mainly the result of a nearly two-fold increase in photosynthetic rates on leaflets grown at high CO2 and the similarity of transpiration rates between both CO2 treatments. Photosynthetic rates accounted for 94% of the relative increase of WUE from 330 to 660 micromol CO2/mol. The CO2 concentration at which WUE is half maximum was not significantly different among leaflets adapted to either the 330 or 660 micromol/mol CO2 treatment. Leaflets adapted to high CO2 levels had higher asymptotic WUE due to a higher capacity of CO2 uptake rates and similar TR. Leaf temperature values were about 2 to 3 degrees C higher at CO2 concentrations of 990 than at 90 micromol/mol in these controlled environment curvelles, indicating a more important role of wind speed for dissipation of leaf sensible heat in high CO2 environments. (Baker-IVI)
W86-00483

RESPONSES OF C4 GRASSES TO ATMOSPHERIC CO2 ENRICHMENT. II. EFFECT OF WATER STRESS,
Duke Univ., Durham, NC. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W86-00484

WATER USE EFFICIENCY OF CASSAVA. III. INFLUENCE OF AIR HUMIDITY AND WATER STRESS ON GAS EXCHANGE OF FIELD GROWN CASSAVA,
Centro Internacional de Agricultura Tropical, Cali (Colombia).
J. H. Cock, M. C. M. Porto, and M. A. El-Sharkawy.
Crop Science, Vol. 25, No. 2, p 265-272, March/April, 1985. 7 Fig, 5 Tab, 22 Ref.

Descriptors: *Water use efficiency, *Humidity, *Water stress, *Gas exchange, *Cassava, Carbon dioxide, Vapor pressure, Leaves, Water potential, Irrigation practices, Conductance, Photosynthesis.

Data is presented on the response of field grown cassava to changes in air humidity with and without soil water stress. There was a remarkable decrease in the leaf photosynthetic rate with decreasing air humidity in both well watered and unirrigated plants. A significant correlation was noted between leaf photosynthetic rate and vapor pressure differences (VPD) and leaf conductance. No correlation was noted with leaf water potential at midday and early afternoon. The midday leaf water potential of the plants without irrigation was slightly higher than that of the well watered plants. Photosynthetic rate of the plants without irrigation was always lower than the well watered ones. Transpiration initially increased with increased leaf to air VPD and then sharply declined with further increases in VPD. Leaf water use efficiency (WUE) decreased in curvilinear pattern with VPD. Dry root yield and total biomass production of cassava was increased by increasing the relative humidity in the crop canopy by artificial misting. There was a 91, 15, and 27% increase in dry root, top and total dry matter, respectively, after 40 days of misting as compared with controls. These differences in biomass production were associated with enhanced photosynthetic rate per unit leaf area of the misted plants. The leaf photosynthetic rate of cassava decreased with leaf age. Photosynthetic saturation irradiance was around 1500 and 800 micromol/sq m/sec for young and old leaves, respectively. (Baker-IVI)
W86-00485

DESIGN AND INSTALLATION OF LARGE WEIGHING LYSIMETERS,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
T. A. Howell, R. L. McCormick, and C. J. Phene.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 106-117, January/February, 1985. 8 Fig, 17 Ref.

Descriptors: *Design criteria, *Lysimeters, *Measuring instruments, Evapotranspiration, Estimating, Water stress, Crop growth.

The design, construction, installation, and calibration of two large weighing lysimeters are described. The lysimeters were designed to allow hourly evapotranspiration measurement, precise daily evapotranspiration measurements, evapotranspiration measurements under water stress conditions requiring a deep root zone, to permit remote data acquisition and control, and to facilitate construction and installation in a location remote from the main research office. The intended purpose of the lysimeters was to calibrate and improve combination equation potential evapotranspiration estimates, measure crop water use for several row crops, and to allow selected micrometeorological research investigations. The lysimeters were constructed in modular sections to facilitate the transport to the installation site and to minimize the use of cranes during the installation. They consisted of 5 main components: inner tank, outer tank bottom, outer tank top, access tunnel, and scale. The lysimeters were installed in a 3.6 ha field. One lysimeter was installed into a field normally used for row crop research, and the other lysimeter was installed into a grass weather station field. The resulting short term sensitivity of the lysimeter has been determined to be about 0.02 mm of evaporation (equivalent mass). The scale consists of a commercial flexure-lever action balance with a load cell final output. No counterbalance was used. The lysimeter scale appears to have excellent stability during windy conditions. (Baker-IVI)
W86-00489

AUTOMATION OF A CLASS A EVAPORATION PAN,
Agricultural Research Service, Mississippi State, MS. Crop Simulation Research Unit.
J. M. McKinion, and A. Trent.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 169-171, January/February, 1985. 5 Fig, 8 Ref.

Descriptors: *Evaporation pans, *Automation, Evaporation, Data acquisition, Stilling wells, Measuring instruments.

A pressure transducer and a stilling well were fitted to a National Weather Service Class A evaporation pan, and the system was tested for suitability for automatic acquisition of data. A ceramic differential pressure transducer (Kavlico Corp.) and a Setra Model 239E +/- 6.8 kPa unit with a stainless steel diaphragm were evaluated in separate tests. These devices provide measurements of water height in the stilling well from which pan evaporation is calculated. Output from the transducers is high-level voltage which can be measured with inexpensive voltage measuring systems. Only normal wiring precautions are needed to transmit the signal to the measurement system. Other applications involving height of a water column may benefit from the present technology, including stilling wells of flow recorders, stream gaging stations, water storage systems, livestock waterers, and spray tank monitors. (Rochester-IVI)
W86-00499

MEASUREMENT OF EVAPORATION AND TRANSPIRATION WITH LYSIMETERS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
N. L. Klocke, D. F. Heermann, and H. R. Duke.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 183-192, January/February, 1985. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Evaporation, *Transpiration, *Evapotranspiration, *Lysimeters, Measuring instruments, Water vapor, Crops, Canopy, Soil water, Water loss, Irrigation.

A project was undertaken to evaluate different methods to measure evaporation (E), transpiration (T), and evapotranspiration (ET) in the field. Measurement techniques were sought for the field using hydraulically weighed lysimeters. The methodology used to obtain E and T measurements and the possible experimental errors associated with these techniques are considered. Sixteen hydraulically weighed lysimeters were studied. Polyethylene film, gravel, and plywood/soil covers were used to suppress soil evaporation from the lysimeters used to measure transpiration. Soil evaporation was measured in uncropped lysimeters that were either shaded or not shaded by the surrounding crop canopy. Summation of the E and T measurements overestimated measured ET by 12% to 24%. Water vapor losses through each of the lysimeter covering materials were measured in the lab. Water vapor conductances were used to estimate the lysimeter cover losses in the field. The water vapor losses through the polyethylene film, gravel and plywood/soil covers in the field were estimated to be 11%, 12%, and 6% of the measured transpiration, respectively. Soil evaporation field data were also adjusted since the crop surrouding the lysimeters for the E measurements had 102 cm rows rather than the 76 cm rows used for the E and T measurements. The summation of the adjusted E and T data were within 1% to 10% of the measured ET. (Baker-IVI)
W86-00501

MODEL TO SIMULATE RESPONSE OF PLANT STOMATA TO ENVIRONMENTAL CONDITIONS,
Hebrew Univ. of Jerusalem (Israel). Seagram Centre for Soil and Water Sciences.
R. Avissar, P. Avissar, Y. Mahrer, and B. A. Bravdo.
Agricultural and Forest Meteorology, Vol. 34, No. 1, p 21-29, February, 1985. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Transpiration, *Stomata, *Simulation, *Model studies, Solar radiation, Leaf temperature, Vapor pressure, Carbon dioxide, Soil water potential.

A semi-empirical model for predicting the stomatal response to solar global radiation, leaf temperature, vapor pressure difference between the leaf and ambient air, ambient air CO2 concentration and soil water potential was developed in order to simulate plant transpiration under different field climatic conditions. In order to determine the different empirical constants needed to run and verify the model, a series of laboratory experiments were

carried out on Nicotiana Tabaccum var. 'samsun' leaves. The plants were grown in pots in a greenhouse. The model was incorporated in a numerical greenhouse microclimate model. The greenhouse model was run for a typical spring day at the coastal region of Israel. Results obtained are in agreement with those previously published, showing that there is no significant interaction effects between the investigated environmental parameters. The use of a simple model is usually sufficient. (Moore-IVI)
W86-00504

WATER USE EFFICIENCY IN A SOYBEAN FIELD: INFLUENCE OF PLANT WATER STRESS,
National Oceanic and Atmospheric Administration, Oak Ridge, TN. Air Resources Atmospheric Turbulence and Diffusion Lab.
For primary bibliographic entry see Field 2I.
W86-00505

EVALUATING PLANT AND CANOPY RESISTANCES OF FIELD-GROWN WHEAT FROM CONCURRENT DIURNAL OBSERVATIONS OF LEAF WATER POTENTIAL, STOMATAL RESISTANCE, CANOPY TEMPERATURE, AND EVAPOTRANSPIRATION FLUX,
National Aeronautics and Space Administration, Greenbelt, MD. Hydrological Sciences Branch.
For primary bibliographic entry see Field 2I.
W86-00506

EFFECT OF STANDING STUBBLE ON SOIL WATER LOSS BY EVAPORATION,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
J. M. Caprio, G. K. Grundwald, and R. D. Snyder.
Agricultural and Forest Meteorology, Vol. 34, No. 2-3, p 129-144, April, 1985. 6 Fig, 6 Tab, 19 Ref. OWRT project B-046-MONT.

Descriptors: *Evaporation, *Soil water, *Stubble, Fallow, Wind, Turbulent exchange.

To assess the effects of standing stubble on evaporative water loss from wet soil surfaces during the growing season, three mini-lysimeters were installed in each of three treatment areas: fallow (bare soil), half stubble (standing stubble cut to half the height left by the combine), and full stubble (standing stubble at the height left by the combine). During the period from August 28 to September 27, 1978, prewet lysimeters containing a soil mix were set in the field between 4:30 p.m. and 5:00 p.m. The soil in the lysimeters was wet beyond field capacity, but there was no free water on the surface when installed in the field. The following day the lysimeters were removed between 4:30 p.m. and 5:00 p.m. and weighed and the depth of water computed. When rain occurred during an observation period, the data for that period were omitted from the study. Nine suitable observations were obtained from August 28 to September 1 and from September 22 to 27. The average daily evaporation for the 9 days from fallow, half stubble, and full stubble was 6.2 mm, 3.6 mm, and 3.7 mm, respectively. Statistical analyses indicated a difference in evaporation between treatments significant at the 1% level. Evaporation from lysimeters in full stubble as a percent of that from fallow lysimeters averaged 60%, and varied from day to day between about 45% and 75%. Evaporation from fallow lysimeters exceeded that from the evaporation pan by about 25%, a difference that may be attributable to the size of the evaporative surface. The reduced evaporation in stubble as compared with fallow appears to be largely attributable to the reduced wind speed and associated turbulent exchange within the standing stubble. There was a close day-to-day relationship in evaporation between the lysimeters in the various treatments. Evaporation from the half stubble and full stubble lysimeters was highly correlated, as might be expected in view of the similar nature of the two treatments. On the other hand, the relatively lower correlations of the two stubble treatments with fallow suggest that environmental factors influencing evaporation operate differently on fallow fields than on stubble fields. An attempt is made to describe quantitatively how environmental factors might have caused the differences in evaporation between treatments noted in this experiment. (Author's abstract)
W86-00507

ENVIRONMENTAL AND PHYSIOLOGICAL CONTROL OF TRANSPIRATION BY GROUNDNUT CROPS,
Nottingham Univ. (England). Dept. of Physiology and Environmental Science.
S. N. Azam-Ali.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 129-140, December, 1984. 7 Fig, 18 Ref.

Descriptors: *Peanuts, *Transpiration, *Water stress, *Plant population, Stomatal resistance, Boundary layer resistance, Leaves, Seasonal variation, Water deficit, Plant physiology.

In central India, four populations of groundnut were grown to assess the interaction between population and water stress. Transpiration was calculated from measurements or estimates of stomatal resistance, boundary layer resistance, vapor concentration difference between leaf and air, and leaf area index. The frequency distributions of stomatal resistance, boundary layer resistance, vapor concentration difference between leaf and air, and seasonal changes in leaf area index were plotted to analyze the dependence of transpiration rate on each variable, both per unit area of leaf surface, and per unit land surface. For estimates of transpiration per unit area of leaf surface, both stomatal resistance and vapor concentration difference were of similar importance, exerting a far greater influence than changes in boundary layer resistance. However, in terms of transpiration per unit land surface, changes in leaf area index were far more important than in any other variable, particularly late in the season when water was scarce. This study provides further experimental support for estimates of evaporation based on stomatal resistance and allied measurements. The ability of the technique to describe temporal and spatial variations as well as the dominant environmental and physiological influences on transpiration may outweigh any small loss in accuracy of estimates thus obtained. (Author's abstract)
W86-00508

ESTIMATING EVAPORATION: A COMPARISON BETWEEN PENMAN, IDSO-JACKSON, AND ZERO-FLUX METHODS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. M. Sadeghi, H. D. Scott, and J. A. Ferguson.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 225-238, December, 1984. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Evaporation, *Soil water, Estimation, Drainage, Soil surface, Wind, Albedo, Soil matrix potentials.

A field evaporation-drainage study was conducted to compare three methods of predicting evaporative losses from a bare soil. Two of the methods (modified Penman combination and Idso-Jackson) are dependent only on measurements of atmospheric parameters whereas the third method (plane of zero flux) is dependent only on measurements of soil parameters. A Captina soil profile was wet up and allowed to dry by evaporation and drainage. For the initial two days after infiltration ceased all three methods predicted similar evaporative losses. Differences between the three methods occurred when the soil moisture content at the soil surface controlled the evaporation rates. Under the three drying conditions the three methods behaved somewhat differently in the prediction of the amounts of water evaporated from the soil surface. Lower losses by evaporation were predicted by the Idso-Jackson and zero-flux methods. In the case of the Idso-Jackson method this result was attributed to the influence of clouds on albedo, the impact of wind and the importance of albedo in the predictive equation. For the zero-flux method the decrease in evaporation was due to the lower soil water contents and matrix potentials near the surface which resulted in lower transport rates of water to the surface. (Author's abstract)
W86-00509

EVAPORATION FROM WET SOIL SURFACES BENEATH PLANT CANOPIES,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
G. K. Walker.
Agricultural and Forest Meteorology, Vol. 33, No. 2/3, p 259-264, December, 1984. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Soil surface, *Evaporation, *Canopy, Corn, Sensible heat, Leaves, Heat transfer.

In studies of latent heat flux from vegetated surfaces, it is often desirable to separate evaporation from the soil surface and transpiration by the vegetation. Concurrent measurements of the net radiation and evaporation from the soil surface beneath maize canopies were made for 24-hour periods, during which the soil surface remained wet. Evaporation from the soil surface often exceeded the radiant energy supply, indicating a downward flux of sensible heat. This effect was greater beneath a denser canopy. The highest value for the sensible heat component, 0.86 MJ/sq m/d, is equivalent to 0.35 mm H2O/d. The production of sensible heat at foliage elements, and its transport to the soil surface, may be important processes in overall canopy energy partitioning. Empirical methods of evaporation estimation from the soil surface beneath a canopy may not be successful under conditions where evaporation depends substantially on heat produced in the canopy and transported to the soil surface. (Moore-IVI)
W86-00510

TRANSPIRATION FROM A KIWIFRUIT VINE AS ESTIMATED BY THE HEAT PULSE TECHNIQUE AND THE PENMAN-MONTEITH EQUATION,
Ministry of Works and Development, Palmerston North (New Zealand).
W. R. N. Edwards, and N. W. M. Warwick.
New Zealand Journal of Agricultural Research, Vol. 27, No. 4, p 537-543, 1984. 3 Fig, 21 Ref.

Descriptors: *Transpiration, *Heat pulse velocity, *Kiwifruit vine, *Penman-Monteith equation, Air temperature, Vapor pressure, Wind, Stomatal conductance.

Heat pulse velocities were measured at 4 depths in the stem of a kiwifruit plant (Actinidia chinensis Planchon) throughout one late-autumn day, and sap velocities and total stem sap flux were calculated from physical principles without restoring the empirical calibration. Concurrent measurements of net radiation, air temperature, vapor pressure deficit, wind speed, and stomatal conductance were utilized in a second, independent calculation of transpiration based on the Penman-Monteith combination equation. Results indicated that most flow occurred in the outer ring or rings of the stem xylem tissue, and there was a close relationship between fluxes estimated by the 2 methods. Heat pulse velocity measurement is potentially a practicable method for measuring transpiration rates in kiwifruit. (Author's abstract)
W86-00516

2E. Streamflow and Runoff

REPORT OF FRESHWATER MOLLUSKS WORKSHOP, MAY 19-20, 1981.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6G.
W86-00329

HABITAT DEVELOPMENT FOR FRESHWATER MOLLUSKS IN THE TOMBIGBEE RIVER NEAR COLUMBUS, MISSISSIPPI,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 8I.
W86-00330

RUNOFF REDUCTION BY VENTING WITH SHALLOW SUBSURFACE DRAINAGE,
Pennsylvania State Univ., University Park.
R. P. Breckenridge, A. R. Jarrett, and J. R. Hoover.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 476-479, March/April, 1985. 5 Fig, 22 Ref. OWRT project A-052-PA.

Descriptors: *Soil properties, *Runoff, *Infiltration, *Subsurface drainage, Permeability, Soil water, Rain, Rainfall-runoff relationships, Drainage, Soil air.

The intensity of a rainfall event, in relation to the soil's infiltration capacity, determines how much rainwater will enter the soil as infiltration. A layer of low permeability within the soil profile can reduce infiltration if the soil air ahead of the wetting front is not vented. The effect of entrapped soil air on the rainfall-runoff relationship was investigated in a soil with an impervious layer within its profile. When the air in the soil was not vented by a drain placed just above the impervious layer, the infiltration rate was reduced from 14 to 73%, depending on the size and distribution of soil pores. As the surface soil dried and cracked, the soil air vented until the cracks filled with water. In these tests, air still remaining within the soil profile was trapped which reduced the infiltration rate after the cracks no longer vented air. The influence of depth of disturbed soil on trapped soil air and the rainfall-runoff relationship was also evaluated. The amount of voids at the beginning of tests on shallow disturbed soil was less than on deeply disturbed soil. The larger amount of voids associated with the deeper disturbed soil resulted in increased infiltration rates for a period near the start of rain; however, the larger volume of trapped air resulted in significantly greater volume of runoff. (Baker-IVI)
W86-00471

2F. Groundwater

HYDROGEOLOGICAL AND GEOTECHNICAL ASPECTS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 8E.
W86-00334

UNWATERING THE DIVIDE CUT OF THE TENNESSEE-TOMBIGBEE WATERWAY; A MAJOR CHALLENGE TO CONSTRUCTION,
Army Engineer District, Nashville, TN.
For primary bibliographic entry see Field 8D.
W86-00335

HYDROLOGY, HYDRAULIC, AND SEDIMENT CONSIDERATIONS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 6G.
W86-00336

GROUNDWATER MONITORING AND SAMPLE BIAS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7B.
W86-00345

GROUNDWATER DEVELOPMENT, KHARGA OASES, WESTERN DESERT OF EGYPT: A LONG-TERM ENVIRONMENTAL CONCERN,
La Moreaux (P.E.) and Associates, Inc., Tuscaloosa, AL.
For primary bibliographic entry see Field 4B.
W86-00554

DETERMINATION OF STORAGE CHARACTERISTICS AND DYNAMIC STRATA PARAMETERS THROUGH TEST WELLS (BESTIMMUNG VON SPEICHEREIGENSCHAFTEN UND DYNAMISCHEN SCHICHTPARAMETERN DURCH TESTARBEITEN),
Forschungsinstitut fuer die Erkundung Foerderung von Erdoel und Erdgas, Gommern (German D.R.).
H.-D. Voigt, and A. Astl.
Zeitschrift fur Geologische Wissenschaften, Vol. 13, No. 1, p 95-101, 1985. 5 Fig, 6 Ref.

Descriptors: *Well tests, *Groundwater storage, Drawdown, Pressure, Permeability, Hydrogeology, Geological fractures, Groundwater reservoirs.

During the test of wells, pressure drawdown and pressure buildup curves are measured, from which permeability, reserve of drainage and static pressure are determined. These curves in different ways are influenced by diverse reservoir heterogeneities, thus the particular heterogeneity may be determined by the form of the recorded curves. The identification of the reservoir heterogeneities is presented for the following four examples: - sealing faults - local changes of permeability - local natural fracturing of a reservoir - layered character of a reservoir. Such interpretation should be carried out taking into account all geological information to obtain reliable results. (Author's abstract)
W86-00587

2G. Water In Soils

PHYSICAL CHARACTERISTICS OF SOILS IN THE SOUTHERN REGION: CECIL,
R. R. Bruce, J. H. Dane, V. L. Quisenberry, N. L. Powell, and A. W. Thomas.
Southern Cooperative Series Bulletin 267, December, 1983. 185 p, 25 Fig, 82 Tab, 7 Ref.

Descriptors: *Soil profiles, *Soil water, *Permeability coefficient, *Soil surveys, *Soil physical properties, *Soil water potential, *Soil moisture retention, *Baseline studies, Soil properties, Soil horizons, Data collections, Cecil soil, Water pressure, Pore pressure, Core logging, Drainage, Alabama, Georgia, South Carolina.

As part of the Southern Regional Project S-124, in situ measurements of soil water pressure and soil water content were made in all horizons of pedons of Cecil soil in Auburn, Alabama, Watkinsville, Georgia, Clemson, South Carolina, and Blacksburg, Virgina at intervals of time during a drainage period of at least 20 days. Water retention was measured on undisturbed soil cores obtained from all horizons at 15 sampling sites. Results were used to compute unsaturated hydraulic conductivity as a function of soil water content over the range experienced during the drainage interval. The extensive soil water pressure data as a function of time and depth and the large amount of soil water content data along with information on other physical characteristics provides an excellent basis for the study of soil water retention and transport in Cecil soil and similar soil bodies.
W86-00343

COMPUTER SIMULATION OF A SPACE SAR USING A RANGE-SEQUENTIAL PROCESSOR FOR SOIL MOISTURE MAPPING,
Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
M. Fujita, and F. T. Ulaby.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-32796. RSL Technical Report 551-1, April 1982. 99 p, 24 Fig, 13 Tab, 9 Ref, append. Contract/Grant No. NAS 9-26429.

Descriptors: *Simulation, *Computers, *Radar, *Soil moisture, *Mapping, Computer models, Remote sensing, SAR, Telemetry.

In this report, the ability of a spaceborne synthetic-aperture radar (SAR) to detect soil moisture is evaluated by means of a computer simulation technique. The computer simulation package includes coherent processing of the SAR data using a range-sequential processor, which can be set up through hardware implementations, thereby reducing the amount of telemetry involved. With such a processing approach, it is possible to monitor the earth's surface on a continuous basis, since data-storage requirements can be easily met through the use of currently available technology. The development of the simulation package is described first, followed by an examination of the application of the technique to actual environments. The results indicate that in estimating soil-moisture content with a four-look processor, the difference between the assumed and estimated values of soil moisture is within +/- 20% of field capacity for 62% of the pixels for agricultural terrain and for 53% of the pixels for hilly terrain. The estimation accuracy for soil moisture may be improved by reducing the effect of fading through noncoherent averaging.
W86-00351

INFILTRATION AND SOIL WATER DISTRIBUTION IN LAYERED SOILS COMPUTED BY GREEN AND AMPT AND RICHARDS MODELS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
R. R. Bruce, and A. W. Thomas.
Presented at the 1983 Winter Meeting of the American Society of Agricultural Engineers, Paper No. 83-2501, December 13-16, 1983, Chicago, IL., 18 p. 14 Fig, 2 Tab, 22 Ref.

Descriptors: *Soil water, *Infiltration, *Soil horizons, *Model studies, *Soil profiles, *Permeability coefficient, *Soil moisture retention, *Mathematical models, Hydrologic models, Prediction, Mathematical studies, Water pressure, Pore pressure, Models.

Experience in estimating infiltration and soil water distributions by Richards, and Green and Ampt models for soils having a range in horizon characteristics is reported. The determination of appropriate hydraulic characteristics for each of three soil horizons, varying from 5 to 40 percent clay, for three soil series received major attention. The effect of magnitude and imcompatibility of soil water retention and hydraulic conductivity characteristics, at matric potentials greater than -1.5 or -2.0 kPa, upon cumulative infiltration is shown. Calculations of cumulative infiltration by the Richards model, both by changes in soil water content profile and by changes in flux, were useful in detecting data incompatibility. The results computed by each model are equally dependent on the reliability of input data for the wet range. Estimates of infiltration by the two models into Cecil, Norfolk and Gardena soil profiles, composed of surface and subsoil horizon, were similar when estimates of infiltration into the uniform systems of each of the horizons were demonstrated to be similar. When reliable estimates of infiltration were made, the rectangular wetting front predicted by the Green and Ampt model intersected that predicted by the Richards model at about one-half the soil water content range of the particular horizon. (Author's abstract)
W86-00377

GROWTH AND WATER USE OF TALL FESCUE AS INFLUENCED BY SEVERAL SOIL DRYING CYCLES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W86-00459

OVERWINTER SOIL MOISTURE CHANGES,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
D. M. Gray, R. J. Granger, and G. E. Dyck.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 442-447, March/April, 1985. 6 Fig, 2 Tab, 38 Ref.

Descriptors: *Soil water, *Seasonal variation, Temperature, Freezing, Thawing, Snowmelt, Irrigation effects, Infiltration.

Moisture migration in response to a temperature gradient during freezing and thawing of unsaturated soils is a complex process involving the thermodynamics of the soil-ice-water regime. Field studies

of the changes in the moisture regimes of some soils in the Canadian Prairies during winter show significant fluxes of moisture migration to the freezing front in both irrigated and dryland areas. The magnitudes of the fluxes are directly related to the moisture content and are greatest in the lighter-textured, irrigated soils having a water table at a relatively shallow depth. In soils which are dry in the fall the net change in the moisture status due to freezing is negligible. Overwinter moisture losses from the soil layer 0-300 mm are most common whereas gains are most frequent in a 1 m depth. The overwinter changes in the surface were independent of the moisture content at freeze-up and the average soil temperature gradient in the zone during the 60 d period following freeze-up. In dryland areas, moisture changes in a 1 m depth due to migration represent, on the average, 50% of the total seasonal change (snowmelt infiltration plus overwinter change). (Baker-IVI)
W86-00466

RUNOFF REDUCTION BY VENTING WITH SHALLOW SUBSURFACE DRAINAGE,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 2E.
W86-00471

THREE-DIMENSIONAL INFILTRATION AND TRICKLE IRRIGATION,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W86-00474

FURROW COMPACTION FOR CONTROLLING EXCESSIVE IRRIGATION WATER INTAKE,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 3F.
W86-00475

INFILTRATION UNDER SURGE IRRIGATION,
Everglades Research and Education Center, Bella Glade.
For primary bibliographic entry see Field 3F.
W86-00478

HYDRAULIC POTENTIAL IN UNFROZEN SOIL IN RESPONSE TO DIURNAL FREEZING AND THAWING OF THE SOIL SURFACE,
Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center.
J. L. Pikul, Jr., and R. R. Allmaras.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 164-168, January/February, 1985. 6 Fig, 21 Ref.

Descriptors: *Soil physical properties, *Hydraulic potential, *Freezing, *Thawing, Frost, Soil water, Temperature, Crops, Vegetation effects, Microclimate.

Sub-surface hydraulic potential changes during daily freezing and thawing of soil surface were measured. The strong influence that crop residue cover has on the daily soil freezing and thawing phenomenon was demonstrated. Surface residue influence the formation of soil frost during late winter freezing and thawing cycles. During 7 consecutive diurnal freezing and thawing cycles in March, soil frost did not form under standing stubble. A bare surface froze to about 1.5 cm during each freezing night. When the soil surface (2 cm) was wet (0.34 cu m/cub m), water moved readily from subsurface layers to the freezing front. During one 6 hr freezing period, volumetric water content increased from 0.31 to 0.57 cu m/cu m at a depth of 0.25 cm. As the soil dried (0.22 cu m/cu m), water movement to the surface became negligible. Hydraulic potential at 2 cm decreased 11.4 kPa during one 7-hr freezing period on 21 March. At 13 cm, diurnal fluctuations of hydraulic potential were nearly damped out. Hydraulic potential during the 7 day period characterized water evaporation from the profile rather than drainage. Soil water evaporation was greater from the bare surface plot than from a standing stubble plot. During one 24 hr period, the bare and stubble-covered plots lost 2.4 and 0.3 mm of water, respectively, from the top 11 cm of soil. High water losses from the bare surface plot should not be considered a consequence of freezing induced water movement only. The surface cover on each plot creates a unique microclimate with different energy and radiation budgets. (Baker-IVI)
W86-00498

EVALUATING THE EFFECT OF INCREASED CONCENTRATION OF CO2 ON INFILTRATION RATE,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
A. R. Jarrett, and J. R. Hoover.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 179-182, January/February, 1985. 4 Fig, 15 Ref. OWRT project A-051-PA.

Descriptors: *Infiltration, *Carbon dioxide, *Soil water, *Hydraulic gradient, Fluid mechanics, Soil properties.

A determination was made as to whether the reduction in infiltration rates observed in soils when the natural soil air is trapped ahead of the wetting front can be reduced or eliminated by replacing the natural soil gas with carbon dioxide. The processes involved in infiltration enhancement with carbon dioxide were also investigated. The carbon dioxide gas was free to escape from ahead of the wetting front, the hydraulic conductivities were increased causing the infiltration rates to be 50% higher in the sand and 56% higher in the loam after 500 s of infiltration than those observed in identical tests using natural soil air in the same two soils. When the carbon dioxide gas was trapped ahead of the wetting front, the effect of the increased hydraulic conductivities was nullified in the sand thus reducing the infiltration rate to values as low as or lower than when the air was trapped. When the carbon dioxide gas was trapped in the loam soil during infiltration, the infiltration rate remained as high as when the carbon dioxide gas was not trapped because the exchange of hydrogen ions for calcium ions in the wetted zone increased the water filled porosity in the wetted zone by 38% thus increasing the hydraulic conductivity which increased the infiltration rates. The hydraulic gradient at the wetting front was also increased due to the reduced gas pressure. The infiltration rates increase when soil gas is provided an easy escape path. When soil air cannot be vented mechanically, practices designed to elevate the carbon dioxide levels in the soil have been shown to effectively increase the infiltration rate. Such practices include keeping soil calcium and soil carbon dioxide levels high through maintaining living, healthy cover crops. (Baker-IVI)
W86-00500

CORN YIELD VARIATION AS RELATED TO SOIL WATER FLUCTUATION AND NITROGEN FERTILIZER. I. SOIL WATER-YIELD RELATIONSHIPS,
Department of Agriculture, Quebec. Research Station.
D. Isfan.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 10, p 1147-1161, September, 1984. 4 Fig, 2 Tab, 19 Ref.

Descriptors: *Soil water, *Corn, *Crop yield, Forecasting, Available water, Rainfall.

The objective of this work was to study the effect of plant available soil water (PAW) in different soil layers before and during the growing season on corn yields (Zea mays L.) and to determine if the soil water may be a reliable index in forecasting the grain yield. The experiments were carried out for 10 years at the same site on a deep-permeable well-drained chernozem with good physico-chemical and biological properties situated in a temperate-continental dry climate with annual precipitation of about 500 mm and wide seasonal and annual fluctuation. The results show that the maximum yields (MY) were highly correlated to water stored in the soil as well as at the beginning as during the growing season. In most cases the yields were better correlated to PAW at the beginning of June ($r = 0.96$) than at the beginning of March ($r = 0.87$) or July ($r = 0.91$). Nevertheless, the July PAW was more efficient in terms of yield per unit of PAW. Thus, 1 mm of PAW within 0-150 cm in March, June and July 1st increases the MY by 16, 21 and 30 kg/ha of grain, respectively. The MY was more related to March and especially to June 1st PAW (0-150 cm) than to June-July precipitation. The PAW from deeper soil layers was in almost all cases better correlated with MY and more efficient. Thus, for the PAW within 0-70 cm on March, June and July 1st the simple correlation coefficients with yields were 0.69, 0.87 and 0.76 respectively while for the PAW within 0-150 cm the correlation coefficients were 0.87, 0.96 and 0.91 respectively. Also, 1 mm of PAW within 0-100 cm on March, June and July 1st increased the yields by 23, 34 and 39 kg/ha while the PAW within 100-150 cm increased the yields by 40, 56 and 78 kg/ha respectively. The results suggest that in this dry area the amount of yield is higly related to PAW at the beginning as well as during the growing season and that soil water may be a good index for forecasting yields as early as three month prior to harvest, except for years with weather accidents in late summer. They also show that PAW from deeper soil layers has a paramount effect on maximum corn yield. (Author's abstract)
W86-00514

CORN YIELD VARIATION AS RELATED TO SOIL WATER FLUCTUATION AND NITROGEN FERTILIZER. II. SOIL WATER-NITROGEN-YIELD RELATIONSHIPS,
Department of Agriculture, Quebec. Research Station.
D. Isfan.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 10, p 1163-1174, September, 1984. 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Corn, *Crop yield, *Soil water, *Nitrogen, *Fertilizers, Available water, Multiple regression analysis, Forecasting, Water use efficiency.

The aim of this study was to determine the relationships between soil water and nitrogen fertilizer and their effect on grain corn yield (Zea mays L.) in a zone where the limiting factor of yield and nitrogen efficiency is the water supply. The experiments were carried out for 10 years on a deep-permeable well-drained chernozem in a temperate-continental dry climate with annual precipitation of about 500 mm. Different nitrogen rates were applied and plant available soil water (PAW) was determined every year before and during the growing season. Multiple regressions were fitted for nitrogen rate, soil water and corn yield. The results show that there is a significant interaction between soil water content, applied nitrogen and corn yield. The soil water explains the greatest part of yield variation, followed by the soil water-added nitrogen interaction effect and the direct effect of added nitrogen. The PAW on July 1st gave a better correlation ($R2 = 0.88$) than June 1st ($R2 = 0.85$) on March 1st PAW ($R2 = 0.72$). But the best correlation was obtained when both June and July PAW were taken together in the regression ($R2 = 0.914$). July PAW was also more efficient in terms of yield per PAW. Thus, 1 mm of PAW on March, June and July 1st increased the control yield by 12.5, 14.6, and 18.3 kg grain/ha respectively, and by 18.0, 22.0 and 32.0 kg grain/ha for the fertilized yield (with 60 kg N/ha). At low soil moisture content, the applied N had no or even negative effect on water use efficiency and yield while at high PAW the water use efficiency was greatly increased by the applied N. (Author's abstract)
W86-00515

2H. Lakes

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF

THE WETLANDS OF THE NORTH ATLANTIC UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. T. Huffman, G. E. Tucker, J. W. Wooten, C. V. Klimas, and M. W. Freel.
Technical Report Y-78-8, May 1982. Final Report. 53 p, 5 Fig, 81 Ref, 1 Append.

Descriptors: *Wetlands, *Hydrology, *Vegetation, *Soil-water-plant relationships, *Plant populations, Bogs, Swamps, Marshes, Lakes, Aquatic habitats, Aquatic plants, Glacial soils, Bottomland, Flood plains, Saline water, Forests, Streambeds, Shores.

This guidebook is intended to help regulatory personnel with the onsite recognition and geographical delineation of wetland boundaries in the North Atlantic United States. The introduction includes general information about wetlands. Major lowland areas are the Seaboard Lowlands of New England, the Ontario Plain in New York, and the large-river valleys: Connecticut, St. Lawrence, Mohawk, and Hudson. Numerous ponds, lakes, swamps, and bogs exist as a result of impervious underlying rock, coarse acidic soils, and glaciation effects. Climatic parameters are highly variable. However, inland areas are usually cool and humid with an average of 102 cm of precipitation each year. Tropical storms have caused major damage in southeastern New England forests. Indicators are described for determining whether vegetation, soil, and hydrological conditions are typically wetland. Wetlands are classified into several groups, each with characteristic vegetation. Aquatic bed wetlands have vegetation which grows on or below the water surface for most of the growing season. Emergent wetlands have erect, rooted, herbaceous hydrophytes (excluding mosses and lichens), mostly perennial. Scrub-shrub wetlands and forested wetlands have woody vegetation less than 6 m high. The streambed class includes nontidal channels containing water for part of the year. Unconsolidated shores have unconsolidated substrates, 30% or less vegetation cover, flooded intermittently.
W86-00316

BENTHIC MACROINVERTEBRATES OF SELECTED AQUATIC HABITATS OF THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. C. Beckett, C. R. Bingham, L. G. Sanders, D. B. Mathis, and F. M. McLemore.
Technical Report E-83-10, April 1983. Final Report. 79 p, 15 Fig, 15 Tab, 43 Ref, 2 Append.

Descriptors: *Aquatic insects, *Macroinvertebrates, *Aquatic animals, *Aquatic habitats, *Benthos, Floods, Mississippi River, River flow, Water currents, Mud, Silt, Sand, Gravel.

Benthic macroinvertebrates distribution in four aquatic habitat types (a natural bank, secondary channel, an abandoned channel, and dike fields) within a 60-mile reach of the lower Mississippi River over one high flow (flood stage), two moderate and two low flow periods between April 1979 and September 1980 is described. The biotas present in the natural bank and in the secondary and abandoned channels showed only minor changes in composition over the various flow regimes. The natural bank was consistently dominated (numerically) by the burrowing mayflies Tortopus incertus and Pentagenia vittigera and hydropsychid caddisflies. The consistently most common taxa in the secondary channel were the sand-dwelling chironomids Robackia claviger and Chernovskiia orbicus. Phantom midges, tubificid oligochaetes, and fingernail clams were always the most abundant macroinvertebrates in the abandoned channel. Macroinvertebrate densities were always high in the mud-bottomed abandoned channel and were always low in the secondary channel. The dike fields showed large changes in biotic composition, which correlated with changes in river stage and resultant alterations in current and substrate. With decreased river stages, substrate dominance changed from erosional (sand and gravel) to depositional (silt). It is concluded that the distribution of macroinvertebrates in the Lower Mississippi River habitats is a function of the physical characteristics (current velocity and substrate composition) of the system. (Author's abstract modified)
W86-00324

INSTRUCTION REPORT ON FRESHWATER MUSSELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller, and D. A. Nelson.
Instruction Report EL-83-2, September 1983. Final Report. 198 p, 22 Fig, 42 Tab, 394 Ref.

Descriptors: *Mussels, *Bivalves, *Mollusks, Commercial fishing, Relocation, Reviews, Sampling, Computer program, Habitats.

This report contains information on the following topics: collecting, preserving, and identifying freshwater mussels; methods for relocating and creating habitat for mussels; the commercial shell industry; and the technical literature concerning mussels. This information will aid in performing impact assessments and endangered species surveys. Techniques for determining the number of samples required to provide a fairly accurate estimate of a population mean are discussed. The simplest and fastest is to calculate cumulative means for a particular species collected in a series of samples. The resulting curve will eventually stabilize near the mean of the population. A more accurate technique is to conduct a pilot survey, determine the average and standard deviation of the sample, and decide what degree of precision is required. Based upon the pilot survey, it is possible to make an estimate of the number of samples needed to satisfy the particular criteria desired. The diversity of the habitat and likelihood of capturing additional, less common, species can be determined by plotting cumulative species versus cumulative individuals. A computer program has been developed which can provide assistance in determining the number of samples required. The program can simulate cluster, random, or uniform distribution patterns. Using random numbers, the program then 'samples' the array and calculates sample means and standard deviation.
W86-00325

VERIFICATION AND TRANSFER OF THERMAL POLLUTION MODEL; VOLUME IV: USER'S MANUAL FOR THREE-DIMENSIONAL RIGID-LID MODEL,
Miami Univ., Coral Gables, FL. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 5B.
W86-00346

USE OF VEGETATION IN DELINEATING WETLAND BORDERS IN UPPER MISSOURI RIVER BASIN; NORTH-CENTRAL UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. C. Johnson, R. A. Mayes, and T. L. Sharik.
Technical Report Y-82-1, Army Engineer Waterways Experiment Station, Vicksburg, MS., August 1982. Final Report. 132 p, 15 Fig, 5 Tab, 14 Ref, 3 Append. Contract/Grant No. DACW39-78-C-0098.

Descriptors: *Wetlands, *Vegetation, *Transition zone, *Sampling, *Upper Missouri River Basin, Species composition, Species diversity, Plant populations, Graphical analysis, South Dakota.

Wetland-nonwetland transition zones in the Missouri River Basin of the North-central United States were studied in seven wetlands ranging in size, permanence, and salinity to develop an efficient sampling methodology that utilized vegetation data to delineate wetland boundaries. One hundred and sixty species of vascular plants occurred in twenty sample transects. Sampling methodology suggested for use in the study area (200-km radius of Sioux Falls, South Dakota) is a combination of the belt transect method (contiguous quadrants) to estimate cover by species and a cover board to measure vertical structure. The methods require a combined sampling time of about 9 minutes/m of transect, corresponding to a sampling time of 3.2 hr for a transect of average length. A streamlined methodology was also devised whereby sampling time could be cut in half. General upper and lower borders of the transition zone were determined from direct gradient analysis graphs. Specific borders were determined from the occurrence of compositional dichotomies displayed in ordination models. The upper border of the transition zone is suggested as the most probable wetland border. This border appears to represent the upper limit of disturbance from wetland processes (siltation during drawdown, ice scouring, variable surface and subsurface hydrologic regime). The transition zone (between emergent aquatic and low prairie zones) is strongly influenced by wetland disturbances and, therefore, contains a large proportion of opportunistic, ruderal species. The lower border of the transition zone is highly variable annually, while the upper border appears to be relatively stable.
W86-00359

INFLUENCE OF THE FISH CLARIAS BATRACHUS ON THE PHYSICOCHEMICAL PROPERTIES OF WATER UNDER LABORATORY CONDITIONS,
Kalyani Univ. (India). Dept. of Zoology.
B. B. Jana, M. Sinha, and S. Gupta.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 107-113, 1984. 2 Tab, 11 Ref.

Descriptors: *Physicochemical properties, *Fish, *Nutrients, Aquaculture, Fish farming, Phosphorus, Nitrogen, Chlorides, Hydrogen ion concentration, Carbon dioxide, Dissolved oxygen.

An attempt is made to measure the changes of physicochemical characteristics of water affected by the different metabolic states of Clarias batrachus under laboratory conditions, as part of a study into production of air-breathing fish. A distinct acidic environment in the water of experimental aquaria was encountered because the values of pH and free CO2 were markedly different between the experimental aquaria and the control. There was a reduced level of oxygen in the experiment aquaria compared to the control. The variations of pH and free CO2 among experimental variants were very minor and could not be accounted for by the differences in the metabolic states of fish. The chloride input through fish excrement in the larger and fed fishes may be much higher compared to the smaller and starved fishes. Food pellets were an important source of chloride in the water. The phosphate content in the experimental aquaria was significantly higher than in the control, which suggests that a significant phosphate loading was ocurring in these aquaria mainly through the droppings of fish. The nitrogen excretion rate was distinctly higher in the large fishes of Clarias batrachus than in their smaller counterparts and these carnivorous fishes have a major role in the nitrogen input of the habitat. The population of heterotrophic and ammonifying bacteria was distinctly higher in the aquaria with large fed fishes compared to other groups of fishes. (Baker-IVI)
W86-00401

CHEMICAL AND PHYSICAL CHARACTERISTICS OF SOME WETLAND WATERS OF KASHMIR,
Kashmir Univ., Srinagar (India). Dept. of Botany.
S. Kaul, and C. L. Trisal.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 137-144, 1984. 2 Fig, 1 Tab, 15 Ref.

Descriptors: *Jammu and Kashmir, *India, *Wetlands, *Physicochemical characteristics, Nutrients, Carbon dioxide, Water temperature, Vegetation, Seasonal variation, Dissolved oxygen, Calcium, Magnesium, Alkalinity, Nitrogen.

Ecosystem analyses of five important wetlands in the Kashmir Valley have been undertaken. The annual cycle of the surface water temperature in the study sites showed a close relationship to that of air temperature. The temperature increased from a spring low to a summer high followed by a decrease until minimum values are recorded in

winter. Oxygen values showed an inverse relationship to temperature. Of the divalent ionic components in different wetland sites, Ca and Mg are the most abundant. The concentration of free carbon dioxide is very low, the dissolved inorganic carbon necessary for photosynthesis being obtained from bicarbonates. The wetland waters are alkaline with pH ranging between 7.2 and 9.6. NO3-N is the most abundant nitrogen source at the present sites. The increase in NO3-N concentration towards winter and early spring may be attributed to the combined result of nitrification at the mud-water interface and the vigorous stirring of wetland waters which eliminates any limiting effects of oxygen diffusion. Both NO2-N and NH3-N are present in low amounts in comparison to NO3-N. In all the five wetlands the time variation and station differences are highly significant. There were however, two exceptions: the site difference was not significant for the water temperature, and time variation, site differences and station differences were not significant in case of alkalinity. (Baker-IVI)
W86-00405

INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Bezirks-Hygieneinspektion und -Inst., Potsdam (German D.R.).
For primary bibliographic entry see Field 5B.
W86-00406

PROBLEM OF INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (ZUR FRAGE DER KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Institut fuer Binnenfischerei, Berlin (German D.R.).
For primary bibliographic entry see Field 5B.
W86-00407

INVESTIGATIONS ON THE INFLUENCE OF LIMNIC MACROPHYTES ON THE DYING RATE OF ESCHERICHIA COLI IN WATER (UNTERSUCHUNGEN ZUM EINFLUSS LIMNISCHER MAKROPHYTEN AUF DIE ABSTERBEGESCHWINDIGKEIT VON ESCHERICHIA COLI IM WASSER),
Medizinische Akademie 'Carl Gustav Carus' Dresden (German D.R.).
G. Burger, and G. Weise.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 301-309, 1984. 5 Fig, 5 Tab, 9 Ref.

Descriptors: *Escherichia, *Macrophytes, *Antibacterial action, Bioassay, Aquatic plants, Bacteria.

In bioassays in aquaria, the death of Escherichia coli was accelerated by the presence of Glyceria maxima, Schoenoplectus lacustris, Alisma plantago-aquatica and Mentha aquatia as compared with check tanks without any plants (initial concentration 15 x 10 to the 9th colony-forming units per ml). As expected, the antibacterial effect of the limnic macrophytes attains it maximum effectiveness within the first days of the period of investigation. The 90% reduction time is shortened by one third to half, and the 99% reduction time is shortened by one fourth to one third. Mean contact times of 7-11 h are required for the decimation of bacteria by 90% and mean contact times of 16-19 h are necessary for a 99% reduction of the population. The antibacterial effect in mixed stands of different plant species possibly increases additively or superadditively. (Author's abstract)
W86-00414

STUDIES ON PRIMARY PRODUCTIVITY AND SOME HYDROCHEMICAL ASPECTS OF A POLLUTED WATER-BODY OF THE HIMALAYAN JHELUM VALLEY,
Jos Univ. (Nigeria). Dept. of Botany.
M. A. Khan.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 539-548, 1984. 8 Fig, 23 Ref.

Descriptors: *Primary productivity, *Lakes, *Jhelum Valley, *Jammu and Kashmir, India, *Trigamsar, Stratification, Temperature, Seasonal variations, Visibility, Turbidity, Phytoplankton, Eutrophication.

The Valley of Kashmir is a lacustrine basin of the inter-montane depression existing between the Lesser and the Great Himalaya. A study was undertaken of the culturally polluted lake Trigamsar for a period of 22 months to evaluate the seasonal variations in the hydrobiological features and to evaluate relationships between the biota and the habitat. During the summer, the surface water temperatures reach as high as 30 C with a sharp decline in the deeper layers. These relatively high temperature values are due to the absorption of heat by the biogenic turbidity of Trigamsar. The oxygen concentration in the suface water varied between 7.6 and 14.5 mg/l throughout the study period. Despite the shallow basin, Trigamsar develops a significant vertical oxygen gradient during March-October. During summer the waterbody was characterized by a typical clinograde oxygen curve indicative of an accelerated eutrophication of the ecosystem. The surface lake water remained supersaturated with oxygen during the greater part of the year. The pH ranged from 8.1 to 9.9 and total alkalinity was principally of the bicarbonate type and fluctuated between 345 and 480 mg/l. Secchi transparency ranged from 0.25 to 0.60 m during the study with higher values being obtained during the winter and the minimum in summer. Lake water is quite turbid. A pronounced seasonal cycle in the phytoplankton production was observed which closely paralleled the seasonal cycle of temperature and light. The values for the photosynthetic efficiency in the water body fluctuated between 0.42 and 2.85% with higher values obtained during summer and the lowest in winter. The phytoplankton population of the Trigamsar was predominantly of Cyanophyceae followed by Chlorophyceae and Bacillariophyceae. (Baker-IVI)
W86-00420

SENSITIVITY OF SOUTHERN QUEBEC LAKES TO ACIDIC PRECIPITATION,
Quebec Univ., Sainte-Foy.
For primary bibliographic entry see Field 5C.
W86-00427

SEDIMENT ACID NEUTRALIZATION IN SOFTWATER LAKES,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
L. A. Baker, P. L. Brezonik, E. S. Edgerton, and R. W. Ogburn, III.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 215-230, 1985. 7 Fig, 5 Tab, 36 Ref.

Descriptors: *McCloud Lake, *Florida, *Lake sediments, *Acidity, *Neutralization, Softwater lakes, Sediments, Calcium, Magnesium, Volatile solids, Storm seepage, Acidification.

The mechanisms and potential magnitude for sediment acid neutralization in softwater lakes was examined. The principal site for this study was McCloud Lake, a small softwater lake in Florida. The lake and its watershed receive minimal human disturbance. The lake is a simple shallow doline that does not stratify thermally and has no inlet or outlet. The lake received 90% of its water from rainfall during 1981-82 and the remainder from subsurface seepage. The littoral sediments are sand interspersed with pockets of peaty material, while the profundal sediments are a highly organic ooze up to 6 m thick. Sediments from seven other lakes in Wisconsin and Florida were used for comparison purposes. Acid neutralizing capacities of sediments from these lakes were as high as 10 meq/100 g over the pH range 4.5 to 5.5 in well mixed batch experiments. Exchange of Ca(2+) and Mg(2+) accounted for over 50% of the neutralizing capacity. Al solubilization and sulfate adsorption were unimportant in neutralizing H(+) additions. Acid neutralizing capacity was correlated with sediment volatile solids content. Sulfate reduction occurred in microcosms that simulated lake-water interactions and subsurface seepage. In situ pore water profiles and a whole-like mass balance confirm the occurrence of this process in McCloud Lake. Sediment neutralization is important for lakes that receive most of their water from precipitation and thus are particularly susceptible to acidification. (Baker-IVI)
W86-00432

ARTICULATION, ACCURACY AND EFFECTIVENESS OF MATHEMATICAL MODELS: A REVIEW OF FRESHWATER WETLAND APPLICATIONS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. Costanza, and F. H. Sklar.
Ecological Modelling, Vol. 27, No. 1/2, p 45-68, March, 1985. 2 Fig, 4 Tab, 65 Ref.

Descriptors: *Model studies, *Wetlands, *Effectiveness, *Optimization, *Mathematical models, Articulation, Accuracy.

Eighty seven mathematical models of freshwater wetlands and shallow water bodies were classified by wetland type, location, and degree of nonlinearity, and rated by three new indices: articulation; accuracy; and effectiveness. Articulation measures the size and complexity of the model in the three modes of components, space, and time. Accuracy combines measures of goodness-of-fit in each mode. Effectiveness measures explanatory power as a combination of articulation and accuracy. Accuracy fell in the models investigated with increasing articulation. This may be a result of increasing complexity and cost. The maximum effectiveness was achieved at intermediate articulation. Effectiveness fell with highly accurate models indicating that such models tend to be low in articulation while highly articulate models tend to be low in accuracy. Such ranking of models may provide a useful guide to model builders who are concerned with maximizing the effectiveness of their models and making use of limited resources. (Baker-IVI)
W86-00433

PHOSPHORUS AND NITROGEN EXCRETION BY LAKE ZOOPLANKTON (ROTIFERS AND CRUSTACEANS) IN RELATIONSHIP TO INDIVIDUAL BODY WEIGHTS OF THE ANIMALS, AMBIENT TEMPERATURE AND PRESENCE OR ABSENCE OF FOOD,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
J. Ejsmont-Karabin.
Ekologia Polska, Vol. 32, No. 1, p 3-42, 1984. 16 Fig, 3 Tab, 66 Ref.

Descriptors: *Phosphorus, *Nitrogen, *Zooplankton, *Lakes, Temperature effects, Cladocera, Copepoda, Rotatoria, Excretion, Nutrients, Food.

The relationship has been determined between the specific rate of P and N excretion by plankton rotifers and crustaceans, and ambient temperature and individual body weights. The rate of excretion is strongly dependent on the temperature, this relationship being of exponential nature. Over the temperature range 10-35 C the Q-10 for the rate of phosphorus excretion was 2.6, for nitrogen -2.4. A power relationship has also been demonstrated between the rate of excretion of both the elements studied and the individual body weight of animals representing three taxonomic groups: rotatoria, cladocera and copepoda. A greater decrease - following an increase in animal body weight - in the rate of the excretion of phosphorus than of nitrogen causes an increase in the N:P ratio in excretion products following a growth of body weight. Starvation of animals prior to measurement caused a decrease in the excretion rate: 1.9 fold in the case of P and 2.2 fold in the case of N. Using the results of this study and some literature data it was possible to build equations describing the effect of body weight and temperature on the rate of P-PO4 excretion. (Baker-IVI)
W86-00435

BIOMASS OF MACROPHYTES IN THE CHANNEL RUNNING THROUGH AGRICULTURAL AREAS,

Polish Academy of Sciences, Poznan. Dept. of Agrobiology and Forestry.
H. Goldyn.
Ekologia Polska, Vol. 32, No. 1, p 167-176, 1984. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Macrophytes, *Channels, *Biomass, Poland, Drainage channels, Aquatic plants, Vegetation, Seasonal variation.

The results of investigations on the biomass of macrophytes conducted in the vegetation season in 1979 in the channel running out from a lake and draining the water from meadows and fields near Turew, Poland are reported. Sparganium simplex and Elodea canadensis were dominant species of vascular plants. The biomass was estimated once a month between June and September for S. simplex, and between June and October for E. canadensis. The maximal biomass of above ground parts of S. simplex was recorded in August, whereas the total biomass of underground parts of this species increased during the whole period of investigations. The biomass of E. canadensis increased during the vegetation season till it attained the maximum in September. The mean biomass of S. simplex during the maximal growth of aboveground parts was 28.0 g dry wt/sq m, whereas the highest one was 85.2 g dry wt/sq m, and the biomass of underground parts was 40% of total biomass. The mean biomass of E. canadensis was 49.4 g dry wt/sq m, whereas the maximal biomass was 426 g dry wt/sq m. The biomass of underground parts was 2.3% of total biomass. The total biomass of all macrophytes growing in the channel, on the average, in plant patches, was 82.02 g dry wt/sq m, whereas on the entire length of the channel part examined including the areas not colonized by vascular plants, it was 30.25 g dry wt/sq m. The biomass of underground parts was 16.3% of total biomass. The majority, that is 83.9% of biomass, of underground parts was produced by S. simplex. (Baker-IVI)
W86-00436

FACTORS INFLUENCING INORGANIC TURBIDITY IN A GREAT PLAINS RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
S. L. Nolen, J. Wilhm, and G. Howick.
Hydrobiologia, Vol. 123, No. 2, p 109-117, April, 1985. 4 Fig, 2 Tab, 38 Ref.

Descriptors: *Reservoirs, *Lake Carl Blackwell, *Oklahoma, *Turbidity, *Opacity, Secchi disc, Fetch, Runoff, Sedimentation, Wind, Rainfall, Model studies, Sediments, Water depth.

Nephelometric and Secchi disc turbidities were measured at 16 sampling sites at Lake Carl Blackwell, Oklahoma on 54 dates from 12 February 1982 to 24 January 1983. Measurements of precipitation, wind velocity, effective fetch, water depth, and sediment particle size were also recorded. Turbidity values ranged from 16 to 1140 NTU and Secchi disc transparency from 2 to 110 cm. Large fluctuations in nephelometric turbidity in upper reaches during early summer resulted from sediment inputs from runoff following heavy May rains. Horizontal gradients of turbidity change during runoff can be attributed to the rapid settling of coarse-grain suspended materials prior to transport to deep-water stations. While sediment inputs from runoff resulted in large turbidity increases during the study, inflow is probably less important in the regulation of turbidity on a long-term basis. Under extremely turbid conditions, drastic increases in nephelometric turbidity resulted in only minimal changes in Secchi disc transparency. Multiple regression models relating nephelometric turbidity to measured climatological and morphometric parameters in the reservoir were constructed. A single easily-measured variable that integrated important parameters influencing sediment resuspension was also developed. Resuspension is primarily a function of wave height and water depth. Cumulative values of rainfall for 1 to 5 days preceeding sampling were correlated with turbidity. A much more useful and practical turbidity model was constructed using data collected prior to heavy rains. (Baker-IVI)
W86-00440

RELATIONSHIPS BETWEEN ZOOPLANKTON ABUNDANCE AND TROPHIC STATE IN SEVEN NEW ZEALAND LAKES,
Waikato Univ., Hamilton (New Zealand). School of Science.
M. A. Chapman, J. D. Green, and V. H. Jolly.
Hydrobiologia, Vol. 123, No. 2, p 119-136, April, 1985. 11 Fig, 12 Tab, 49 Ref.

Descriptors: *Zooplankton, *Lakes, *Rotorua, *New Zealand, Trophic level, Population dynamics, Copepods, Cladocera, Crustaceans, Population dynamics.

Zooplankton communities were studied in 1977-78 in lakes of different trophic status in Rotorua, New Zealand. In six of the seven study lakes, the zooplankton was usually dominated by calanoid copepods but even in Lake Tikitapu calanoids were of similar abundance to cladocerans. Such a predominance of calanoid copepods is typical of many New Zealand lakes though cladocerans may be seasonally more abundant in some cases. There does not seem to be a clear-cut relationship between trophic status and the type of community. Despite the similarities in species composition in the study lakes they clearly differed in the abundance of zooplankton with the greatest contrasts between Lakes Okaro and Ngapouri, where numbers were generally highest, and Lake Tikitapu in which populations were very much smaller. Certain features were common to all. Population sizes varied during the year by less than an order of magnitude in contrast to fluctuations over two or three orders in perennial species in northern hemisphere temperature lakes. The fluctuations that did occur varied between the lakes with no common pattern. A third feature was the continuously low clutch sizes and often low percentages of breeding females found in all the crustacean species. In both the cluster analyses and the principal component analysis the differences between the lakes were most marked in the warmer months particularly when the volumetric data were tested. The greater sensitivity of these data presumably reflects the importance of nutrient dilution in relation to plankton productivity. The use of zooplankton as integrators of biological conditions avoids the problems of interpreting data influenced by morphometric features of lakes such as hypolimnetic oxygen deficits or macrobenthos standing crops, while the long generation times of copepods in particular enable less frequent sampling than is required for phytoplankton. (Baker-IVI)
W86-00441

SPRING BENTHIC MACROINVERTEBRATE COMMUNITIES OF SELECTED STREAMS IN THE HIGH CAUCASUS (AZERBAIJAN SSR),
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
A. Kownacki.
Hydrobiologia, Vol. 123, No. 2, p 137-144, April, 1985. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Invertebrates, *Streams, *Caucasus, *Azerbaijan SSR, *USSR, Population dynamics, Fauna, Aquatic insects.

Invertebrates were collected at fifteen sites in streams of the Caucasus (Azerbaijan SSR) in March of 1970: 75 taxa of invertebrates were found. The most numerous group, as far as number of taxa and abundance of specimens are concerned, was Chironomidae. Usually their quantity exceeded 50% of the total abundance of invertebrate fauna and at some sites, even 90%. Ephemeroptera, Plecoptera, and Simuliidae were the other important components of the fauna. The total abundance of the fauna differed greatly at particular sites. Least abundance was recorded in the stream Kishchay and its tributary Domarchynchay. Greatest abundance was found in a nameless tributary of the stream Dagirmanchay. The total abundance of the fauna usually varied at particular sites from 300 to 900 specimens. Four community groups were distinguished. It was determined that spring time in high mountain streams and rivers was more conducive to the development of the invertebrate fauna. (Baker-IVI)
W86-00442

CHARACTERIZATION OF BENTHIC MICROHABITAT; AN EXPERIMENTAL SYSTEM FOR AQUATIC INSECTS,
Illinois Univ. at Urbana-Champaign. Dept. of Urban and Regional Planning.
L. L. Osborne, E. E. Herricks, and V. Alavian.
Hydrobiologia, Vol. 123, No. 2, p 153-160, April, 1985. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Benthos, *Microhabitats, *Aquatic insects, Insects, Population dynamics, Thermistors, Flow velocity, Streams, Channels, Benthic environment, Habitats.

An experimental system used to determine microhabitat current velocity and microhabitat selection by aquatic insects is described. The system includes a microvelocity probe and a hydraulically calibrated artificial substrate. A thermistor velocity probe detects flow velocities to 0.5 m/sec near the surface of substrates at locations inhabited by aquatic insects. The artificial substrate was designed to provide two major habitat types, highly turbulent vortex areas and region with unidirectional, near laminar flow. Substrate calibration and microhabitat characteristics of the substrates are demonstrated. Experimental studies of Simulium sp. location on substrates indicated that while simuliid larvae are characteristic of lotic, erosional habitats, actual microhabitats selected are governed by substantially lower flow velocity. One major advantage of the system is that once a substrate configuration is hydraulically analyzed and calibrated, the calibration will not change. Standard substrates can be used in a number of field situations providing similar information for a number of taxa. The system also permits determination of microhabitat velocity with minimal disturbance to the organism. Experimental studies of aquatic insect behavior, evaluations of competition, and general descriptions of life history and environmental relationships may all be enhanced through the use of such a system. Critical microhabitat variable(s) can be kept constant allowing careful evaluation of the effects of either chemical or biological modification of environmental conditions on aquatic insects. (Baker-IVI)
W86-00443

REACTION OF LARVAE OF SIMULIUM NOELLERI (DIPTERA) TO DIFFERENT CURRENT VELOCITIES,
London Univ. (England). Dept. of Biological Sciences.
R. S. Wotton.
Hydrobiologia, Vol. 123, No. 3, p 215-218, 1985. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *Water currents, *Behavior, *Aquatic insects, Blackflies, Larvae, Velocity, Animal behavior, Insect behavior.

Experiments were conducted to determine whether larvae of different sizes of Simulium noelleri reacted differently to a range of current velocities, using the extent of upstream movement by looping as an indication of differences. As current velocity decreased, a significantly higher percentage of larvae moved more than 50 cm upstream in the course of 90 minutes. In studying the size of larvae which moved more than 10 cm upstream from where they had been placed, overall length measurements were grouped into categories and the percentage of the total number of larvae within each size category which moved more than 10 cm upstream after at least 90 min, had elapsed was plotted against current velocity. The larger a larva becomes the more likely it is to move upstream in lower water velocities, or, conversely, smaller larvae have a greater tolerance of low velocities. Concerning the distance travelled by larvae per unit time, the maximum speed of upstream migration was recorded in four of the experiments when, in each case, one larva moved 40 cm upstream at a rate of .067 cm/sec. Speeds of over .06 cm/s were commonly recorded in the first ten minutes of experiments. (Baker-IVI)
W86-00445

EFFECTS OF METAL SPECIATION ON GROWTH OF PHYTOPLANKTON WITH SPECIAL REFERENCE TO IRON,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
For primary bibliographic entry see Field 5C.
W86-00455

SURVEY OF THE DISTRIBUTION OF CHIRONOMIDAE (DIPTERA, INSECTA) OF THE RIVER RHINE BY SAMPLING PUPAL EXUVIAE,
Bristol Univ. (England). Dept. of Zoology.
R. S. Wilson, and S. E. Wilson.
Hydrobiological Bulletin, Vol. 18, No. 2, p 119-132, December, 1984. 4 Fig, 4 Tab, 36 Ref, 1 Append.

Descriptors: *Rhine River, *Midges, *Distribution, Europe, Aquatic insects, Population dynamics, Water pollution effects, Species composition, Ecological distribution, Sediments.

The Rhine rises in the Swiss Alps and discharges to the North Sea. In 1981, the Rhine was sampled for chironomid pupal exuviae. The Grande Canal d'Alsace and selected tributaries were also sampled. In the 78 samples taken, 9771 exuviae were examined and 135 taxa identified. A species list shows the distribution of taxa between the principal regions of the river. Above the Bodensee the Rhine has a diverse fauna dominated by Orthocladiinae. The Hochrhein near the entry of the River Aare, and the River Aare itself, also have a diverse fauna, but include many sediment dwelling Chironominae. Below Strasbourg the fauna changes markedly, losing most of its sediment dwellers, and shows a great increase of pollution tolerant strains. The fauna generally becomes less diverse and of poorer quality throughout the Oberrhein sections, and faunal changes are related to the inflow of the Rivers Neckar and Main. Samples from the Mittelrheingorge and the Niederrhein are generally dominated by two species of Rheotanytarsus and show a progressive reduction of diversity coupled to an increase of pollution tolerant species. The low proportions of sediment dwellers in the Niederrhein and the Waal, suggests that the sediments are unsuitable for the support of a normal chironomid fauna, possibly through the accumulation of toxic materials. (Baker-IVI)
W86-00457

LONGITUDINAL DISTRIBUTION OF MACROINVERTEBRATES AND FISH IN A LOWER NIGER DELTA RIVER (RIVER SOMBREIRO) IN NIGERIA,
Port Harcourt Univ. (Nigeria). Dept. of Zoology.
C. S. Nwadiaro.
Hydrobiological Bulletin, Vol. 18, No. 2, p 133-140, December, 1984. 1 Fig, 3 Tab, 23 Ref.

Descriptors: *Macroinvertebrates, *Fish, *Niger River, *Sombreiro River, *Nigeria, *Spatial distribution, Distribution patterns, Streams, Rivers, Aquatic insects, Crustaceans, Mollusks, Annelids, Arachnids, Water chemistry.

Samples were taken monthly from November 1979 to June 1982 at six stations located along the River Sombreiro, Nigeria. The macroinvertebrate community was dominated by Crustacea and Insecta, followed by mollusks, annelids and arachnids. Their respective contributions to the taxonomic composition of the river were 36%, 34%, 15%, 9%, and 6%. The Crustacea were virtually restricted to the downstream brackish water stations where they were very abundant and taxonomically more diverse. The mollusks were found exclusively in the lower and alkaline zone of the river. The location of the fish and division by species further confirms the roughly divided two zones of the river with the physicochemical, macroinvertebrate and ichthyofaunal boundaries located between Lat. 4 degrees 55 minutes and 4 degrees 48 minutes N and Long. 6 degrees 42 min and 6 degrees 47 min E. The upper zone has insects, oligochaetes and arachinids as the dominant invertebrate fauna and the dwarf cichlids as its diagnostic fish species. The lower zone has Crustacea and Mollusca as the cardinal invertebrate fauna and the monodactylid Monodactylus sebae as its distinctive fish type. The dominating factors in the zonation of the river into two zones are mainly chemical (salinity, alkalinity, total hardness) and to a much less extent physical (current velocity and the associated substrate composition). (Baker-IVI)
W86-00458

USE OF DIALYSIS CELLS FOR INVESTIGATING PORE WATER COMPOSITION IN WETLAND SUBSTRATA, WITH PARTICULAR REFERENCE TO DISSOLVED IRON AND SULPHIDE,
Sheffield Univ. (England). Dept. of Botany.
B. D. Wheeler, and K. E. Giller.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 6, p 707-716, June, 1984. 1 Fig, 1 Tab, 13 Ref.

Descriptors: *Dialysis cells, *Sampling, *Interstitial water, *Wetlands, Iron, Sulfides, Peat, Anaerobic conditions, Substrate.

A dialysis method is described for sampling pore water from depth in wetland substrata (peats). The method is designed particularly to permit collection of large sample volumes (50-150 ml free from colloidal or particulate material while minimizing changes in concentrations of dissolved ions as a result of sampling. The method is based upon the burial and subsequent retrieval (after equilibration) of cells made from dialysis membrane filled with deionized water. Field investigations of concentrations of dissolved iron and sulfide in the pore water of base-rich mires were made using this method. The dialysis cell method is simple and cheap. The filled cells are surprisingly robust and amenable to handling in field conditions. It seems probable that the method could be of considerable value in investigating pore water composition in anaerobic wetland substrata. (Moore-IVI)
W86-00511

PHOTOSYNTHESIS AND PRIMARY PRODUCTION OF MICROCYSTIS AERUGINOSA KUTZ. IN LAKE KASUMIGAURA,
National Inst. for Environmental Studies, Tsukuba (Japan). Environmental Biology Div.
N. Takamura, T. Iwakuma, and M. Yasuno.
Journal of Plankton Research, Vol. 7, No. 3, p 303-312, 1985. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Photosynthesis, *Primary productivity, *Microcystis, *Lake Kasumigaura, *Japan, Solar radiation, Water temperature, Cyanophyta, Algae.

Seasonal changes in the photosynthesis and primary production of Microcystis aeruginosa Kutz. were investigated in Lake Kasumigaura (Japan) during 1981-1982. Microcystis always showed a light-saturated photosynthesis-light curve. Both Pmax and the initial slope of the photosynthesis-light curve of Microcystis in early summer were very high, so it was concluded that Microcystis utilized both low and high intensities efficiently. The Pmax of Microcystis was found to be a function of the water temperature except in August and September. The linear regression on the temperature-Pmax relationship discontinued at 11 C, where the Pmax value dropped; Microcystis did not photosynthesize below 4 C. The initial slope of the curve was also descending below 11 C. It is suggested that Microcystis changes its physiological properties below 11 C. The highest value of gross production calculated for M. aeruginosa was 5.4 gC/sq m/d in July; the annual gross production was estimated to be 300 gC/sq m/year (i.e., 40% of the total primary production in this lake). (Author's abstract)
W86-00518

LIMNOLOGICAL STUDIES OF WATERFOWL HABITAT IN SOUTH-WESTERN NEW SOUTH WALES. I. WATER CHEMISTRY,
Commonwealth Scientific and Industrial Research Organization, Lyneham (Australia). Div. of Wildlife and Rangelands Research.
S. V. Briggs, M. T. Maher, and S. M. Carpenter.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 59-67, 1985. 2 Fig, 2 Tab, 30 Ref.

Descriptors: *Limnology, *Water chemistry, *New South Wales, Lake Merrimajeel, *Murrumbidgil Swamp, Hydrogen ion concentration, Wetlands, Water level, Dissolved oxygen, Sodium, Potassium, Calcium, Chlorides, Nitrates, Phosphates.

Field investigations were undertaken at two wetlands near Booligal in southwestern New South Wales, which are typical of many in inland southeastern Australia. Murrumbidgil Swamp is approximately circular with a diameter of 1000 m. It is dominated by river red gum and supported a variety of submerged and floating vegetation. Lake Merrimajeel is an elliptical depression, approximately 750 m by 1500 m, with scattered shrubs of lignum and a dense submerged aquatic vegetation. Lake Merrimajeel is filled via a natural channel from Murrumbidgil Swamp. Water chemistry in the two impermanent wetlands was studied as part of a larger investigation into the relationship between water level rises and waterfowl breeding in such wetlands. Except for pH and oxygen, the wetlands were chemically similar, as would be expected because they are connected. Sodium, potassium, calcium and chloride concentrations, conductivity and pH were inversely related to water level. Total loads of iron, phosphate, nitrate and sulfate increased as the wetlands flooded during wetting phases. Nitrate and phosphate levels in experimental tanks also peaked after flooding. The high nutrient levels in freshly flooded wetlands and tanks suggest that release of nutrients from dry soil following reflooding occurred in Murrumbidgil Swamp and Lake Merrimajeel. (Moore-IVI)
W86-00522

PHYTOPLANKTON OF THE LA TROBE RIVER, VICTORIA,
Latrobe Valley Water and Sewage Board, Traralgon (Australia).
B. C. Chessman.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 115-22, 1985. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Phytoplankton, *La Trobe River, *Victoria, Chlorophyll a, Algae, Diatoms, Spatial distribution, Lake Narracan, Eutrophication, Seasonal variation, Flow discharge.

The La Trobe River is one of the largest streams of southeastern Victoria, rising about 75 km east of Melbourne and flowing to Lake Wellington, at the western extremeity of the Gippsland Lakes. Phytoplankton was sampled on a monthly basis for 1 year at five stations on the La Trobe River. In the upper, mostly forested, reaches of the river, chlorophyll a concentrations and cell densities were uniformly very low, and the dominant algae were detached benthic diatoms and flagellated species. In the plains section of the river, downstream of an impoundment (Lake Narracan), spring and autumn blooms occurred, with a marked reduction in abundance in midsummer and midwinter. Most true phytoplankters were observed only in Lake Narracan and stations downstream. The lowland planktonic flora was dominanted by centric diatoms, particularly Melosira distans in autumn and Skeletonema potamos in spring. Attempts to relate the seasonal changes in phytoplankton populations of the lower La Trobe the hydrographic, temperature, and nutrient concentration data from routine river monitoring were not entirely successful. The marked increase in populations in October and decline in June did coincide closely with a respective decrease and increase in river discharge at these times. (Moore-IVI)
W86-00523

IN SITU MEASUREMENTS OF UPTAKE OF INORGANIC CARBON AND NITROGEN BY THE AQUATIC LIVERWORTS JUNGERMANNIA VULCANICOLA STEPH. AND SCAPANIA UNDULATA (L.) DUM. IN AN ACID STREAM, KASHIRANASHIGAWA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.

T. Miyazaki, and K. Satake.
Hydrobiologia, Vol. 124, No. 1, p 29-34, May, 1985. 5 Tab, 27 Ref.

Descriptors: *Liverworts, *Carbon, *Nitrogen, *Acid streams, *Kashiranashigawa, *Japan, Aquatic plants, Solar radiation, Nitrates, Ammonium, Nutrients.

In situ uptake of inorganic carbon and nitrogen by the aquatic liverworts Jungermannia vulcanicola Steph. and Scapania undulata (L.) Dum. was measured in an acid stream, Kashiranashigawa, Japan. The uptake activities were similar in the both species. The activities were highest at the tip of shoots, and decreased gradually towards the base. Carbon uptake at the tip in the light was 0.00104 for J. vulcanicola and 0.00082 g C/g dry wt/h for S. undulata. Ammonium was effectively incorporated into the shoots, and the uptake activity at the tip was between 0.000019 and 0.000058 g N/g dry wt/h. Nitrate uptake was smaller than ammonium uptake. The ratio of dark to light uptake in ammonium uptake experiments was larger than that in carbon uptake experiments. These results suggest that the liverworts use ammonium as a major nitrogen source, and that ammonium uptake was less dependent on light than carbon uptake. (Author's abstract)
W86-00529

LANDSAT STUDY OF THE AQUATIC VEGETATION OF THE LAKE LUODONJARVI RESERVOIR, WESTERN FINLAND,
Oulu Univ. (Finland). Dept. of Astronomy.
J. Raitala, and J. Lampinen.
Aquatic Botany, Vol. 21, No. 4, p 325-346, April, 1985. 5 Fig, 2 Tab, 20 Ref.

Descriptors: *Satellite technology, *Aquatic plants, *Lake Luodonjarvi, *Finland, Remote sensing, Reservoirs, Mapping, Spectral reflectance.

Lake Luodonjarvi (Finland) is situated on the Gulf of Bothnia coast and was formed by the damming of what was formerly a brackish-water sea-bay in 1962. The lake area has been effectively overgrown in places. The Loudonjarvi and Ojanjarvi open water areas were studied using Landsat MSS imagery which consists of 4 spectral bands and allows different surface units with characteristic spectral reflectances to be identified down to the minimum resolution (0.5 ha). Spectral differences were detected between different water areas. Seventeen aquatic complexes or types were classified separately on the basis of changes in water characteristics and depth, bottom quality and vegetational succession. The vegetation in summer 1983 was recorded in this way and reviewed against previous mappings in order to illustrate the multitemporal aspects of Landsat studies. The analysis of Landsat MSS data values and associated ground verification data provides a useful map of the extent and location of the overgrown portion of the lake and environmental changes within the area, and can be used to predict the direction of succession trends which are controlled by local conditions. (Moore-IVI)
W86-00532

RECORDING ECHO SOUNDER FOR ASSESSING SUBMERGED AQUATIC PLANT POPULATIONS IN SHALLOW LAKES,
Agricultural and Food Research Council, Oxford (England). Weed Research Organization.
For primary bibliographic entry see Field 7B.
W86-00533

FRESHWATER NAIAD (MUSSEL) FAUNA OF THE NOLIN RIVER IN THE GREEN RIVER DRAINAGE OF CENTRAL KENTUCKY (MOLLUSCA: BIVALVIA),
Marshall Univ., Huntington, WV. Dept. of Biological Sciences.
R. W. Taylor.
Nautilus, Vol. 97, No. 3, p 109-112, July, 1983. 4 Ref.

Descriptors: *Mussels, *Nolin River, *Kentucky, Clams, Endangered species, Distribution, Green River Drainage.

A survey of the freshwater mussels (naiads) of Nolin River of the Green River, Kentucky, drainage, produced specimens of twenty-one species of naiads, and the Asian Clam, Corbicula fluminea. Six of the species reported from the Nolin are considered Endangered or of Special Concern by the Kentucky Academy of Science. Villosa ortmanni is considered endangered by most malacologists because it is restricted in distribution to the Green River drainage. At present, however, it is the most commonly found species in the Nolin River. (Author's abstract)
W86-00534

UNIONIDS (BIVALVIA) OF LOCH RAVEN RESERVOIR, MARYLAND,
P.O. Box 144878 Coral Gables, FL 33114.
G. A. Long.
Nautilus, Vol. 97, No. 3, p 114-116, July, 1983. 1 Fig.

Descriptors: *Mussels, *Loch Raven Reservoir, *Maryland, Water levels, Water currents, Distribution, Behavior.

A 6-yr informal study of mussels in Loch Raven Reservoir, Maryland (USA), yielded 600 specimens, all of which belonged to three species: Anodonta cataracta Say 1817, Lampsilis radiata radiata (Gmelin 1791), and A. imbecillis Say 1982. Four sites were collected: (1) Deadman's Cove, the main channel of Gunpowder Falls, south of Dulaney Valley Road bridge, east of Warren Bridge, and at the Fishing Center. A. cataracta cataracta represented 75% of the shells collected, and was found in quantity at all sites. L. radiata radiata specimens were second in abundance, and A. imbecillis was third, being found at two sites in a growth series that suggested a viable, self-sustaining population. Ninety percent of the specimens of all the taxa collected were dead, having recently expired due to receding water levels. The two species of Anodonta were very active in the substrate, particularly as water levels were reduced, and their directions of movement suggested that as water levels reached less than 0.5 m, the animals were deliberately seeking deeper water. All Lampsilis specimens were found on a substrate normally submerged under deeper water than that in which the bulk of the Anodonta specimens were found (no less than 2 m). All Lampsilis specimens were found at the edge of the swiftest available current in the collection area. Overall, more than 60% of the Lampsilis specimens were found at the Dulaney Valley Road bridge site, where the current is the strongest and most consistent of the entire impoundment. (Rochester-IVI)
W86-00535

LIMNOLOGICAL STUDIES OF RASHDIYAH RESERVOIR, BAGHDAD, IRAQ,
Biological Research Center, Baghdad (Iraq). Dept. of Zoological Sciences.
A. N. Khalaf, A. K. M. S. Islam, M. S. Mohammed, and A. R. Al-Jafery.
Journal of Biological Sciences, Vol. 14, No. 1, p 25-45, 1983. 9 Fig, 9 Ref.

Descriptors: *Limnology, *Rashdiyah Reservoir, *Iraq, Reservoirs, Water temperature, Solar radiation, Rainfall, Dissolved oxygen, Carbon dioxide, Alkalinity, Salinity, Calcium, Magnesium, Sulfates, Bicarbonates, Phytoplankton.

The physical, chemical and biological conditions of Rashdiyah reservoir (Iraq) were investigated between December, 1979 and November, 1980. Water temperature varied between the depths of a station as well as among the stations on a given sampling date. Duration of sunshine was highest in August and lowest in January and February. Relative humidity was highest in December, January and February and lowest in September. Average rainfall was the highest in February and there was no rainfall at all from May to October. Dissolved oxygen was highest in January and lowest in August. Free carbon dioxide was highest in July and lowest in January. The water of the reservoir were slightly alkaline throughout the period of study. The periods of higher temperatures were accompanied by higher concentrations of salinity. Calcium and magnesium among the cations and sulfate and bicarbonate among the anions dominated during the investigation. The nutrients under consideration showed two peaks one in March and a second one in November. Phytoplankton population showed two maxima one in March and a second one in November. Attempts were also made to correlate the influence of the physicochemical factors upon the growing condition of phytoplankton in the reservoir. (Author's abstract)
W86-00536

CONTRIBUTION TO THE APPLICATION OF THE REGRESSION ANALYSIS IN CONNECTION WITH THE ESTIMATION OF THE PRIMARY PRODUCTION IN THE GROSSER MUGGELSEE (BERLIN) FOR THE PERIOD OF 1979-1982 (EIN BEITRAG ZUR ANWENDUNG DER REGRESSIONSANALYSE IM ZUSAMMENHANG MIT DER SCHATZUNG DER PRIMARPRODUKTION IM GROSSEN MUGGELSEE (BERLIN) FUR DEN ZEITRAUM 1979...1982),
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
R. Stellmacher, and B. Nixdorf.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 653-657, 1984. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Muggelsee, *Germany (Democratic Republic), *Primary productivity, Regression analysis, Water quality, Statistical methods, Mathematical studies.

The lake Muggelsee (German Democratic Republic), which is important for the drinking water supply of Berlin, has been thoroughly investigated for some years with respect to its quality state and conversion of substances. To reduce working time and material expense for measuring of the primary production, various mathematical-statistical possibilities are checked with the aid of the results of series of investigations which have been performed for years. Of the calculating methods studied, the linear regression through the origin and the exponential approach provided the best approximation of measured and calculated results of the surface integral of the primary production as estimated from the production value of the optimum horizon for the Muggelsee type of lake. (Author's abstract)
W86-00551

VARIATION OF CHEMICAL PARAMETERS IN THE DEPTH PROFILE OF THE RIVER CHAMPANALA,
S.M. Coll., Bhagalpur (India). Dept. of Zoology.
R. Hasan.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 679-683, 1984. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Champanala, *India, *Chemical properties, *Water depth, Stratification, Velocity, Flow discharge, River flow, Water temperature, Alkalinity, Dissolved oxygen, Carbon dioxide, Hydrogen ion concentration.

The River Champanala (India), which derives its flow from the Ganges during flood, and reenters the Ganges after about 20 km, exhibited a temporary chemocline in late October, 1978, when sampling of a profile at about 0.5 km upstream from its confluence with the Ganges was conducted. At that time, the mean velocity of flow was 2.75 m/sec, and the discharge was 546 cu m/sec (based on linear interpolation from sampling done at other times); the depth of the river at the time of sampling was 1.68 m. Temperature declined gradually from the surface (29.0 C) to 0.76 m (28.0 C), and then declined to 27.8 C at 1.37 m, being the same at the bottom. Carbonate alkalinity was nil throughout the profile, CaCO3 was 148.0 ppm throughout the profile, dissolved oxygen declined from 9.5 ppm at the surface to 9.3 ppm at 0.76 m, and then to 6.4 ppm at the bottom. Free carbon dioxide was 2.2 ppm at the surface, 4.5 ppm at 0.76 m, and 1.8 ppm at 1.07 m, and only 1.5 ppm at the bottom. pH was 8.0 from the surface to 0.76 m, declining to 7.6 at the bottom. High photosynthetic activities probably account for the dissolved oxygen profile, whereas the C02 profile may be accounted for by

the shallow depth of flow and comparatively high velocity of flow, as well as high respiration. (Rochester-IVI)
W86-00552

STUDIES ON RIVERINE ECOLOGY OF TORRENTIAL WATERS IN THE UPLANDS OF THE GARHWAL REGION, II. SEASONAL FLUCTUATIONS IN DIATOM DENSITY,
Garhwal Univ., Srinagar (India). Dept. of Zoology.
P. Nautiyal.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 671-674, December, 1984. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Diatoms, *Seasonal variation, *Streams, *Garhwal, *India, Alaknanda, Nayar, Water temperature, Silt, Monsoons, Water currents.

Seasonal fluctuations along with certain physicochemical parameters were recorded for two hill-streams, the Alaknanda (snow-fed) and the Nayar (spring-fed) in the Garhwal Region (India), In the former, the water temperature range of 9-14 C is considered optimum for the growth of diatoms, compared to 12-21 C in the Nayar. In both hill-streams diatoms achieved their maxima during January, when the water temperature is the lowest. Sudden influx of rain water carrying enormous silt during monsoon is responsible for the decline in density. The water temperature and current, especially the latter is thus a detrimental factor. The interesting feature of the study is, the relatively higher percentage of diatoms in the Nayar than in the Alaknanda, obviously to be attributed to the warm waters in the former. (Author's abstract)
W86-00576

SEASONAL VARIATION IN PRIMARY PRODUCTION IN RELATION TO SOME LIMNOLOGICAL FEATURES IN LAKHOTIA LAKE (INDIA),
Jodhpur Univ. (India). Dept. of Zoology.
T. C. Khatri.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 697-702, December, 1984. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Limnology, *Primary productivity, *Lakhotia, *India, Lakes, Seasonal variation, Chlorophyll a, Water temperature, Alkalinity, Monsoons.

Lakhotia is a man-made, rain-fed, perennial lake in Pali city, in the semiarid region of Rajasthan, India. The primary production of the lake was determined and compared with other tropical and temperate water bodies. The annual gross production in Lakhotia was 1956.035 gC/sq m. The maximum gross primary production was recorded during summer when there was an increase in water temperature, chlorophyll-a and alkalinity. After attaining a peak in June, the alkalinity declined sharply during monsoon and consequent flood, and in winter it increased again. High production was observed when temperatures ranged from 27-33 C. The difference between gross and net primary production was wide, the percentage of respiration in gross production being 15.6-100. Primary production in Lakhotia is moderate. Chlorophyll-a and water temperature act as favorable factors, whereas transparency and alkalinity are limiting factors. (Moore-IVI)
W86-00578

PROBABILITY-OF-USE FOR DEPTH, VELOCITY, AND SUBSTRATE BY SUBYEARLING COHO SALMON AND STEELHEAD IN LAKE ONTARIO TRIBUTARY STREAMS,
New York State Dept. of Environmental Conservation, Albany. Bureau of Environmental Protection.
J. D. Sheppard, and J. H. Johnson.
North American Journal of Fisheries Management, Vol. 5, No. 2B, p 277-282, Spring, 1985. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Salmon, *Water depth, *Velocity, *Substrates, *Streams, New York, Lake Ontario tributaries, Coho, Steelhead, Habitats, Streamflow, Seasonal variation.

Probability-of-use information for depth, velocity, and substrate by subyearling coho salmon (Oncorhynchus kisutch) and steelhead (Salmo gairdneri) in three New York tributaries of Lake Ontario was obtained during June and October in 1980. In June, coho salmon occurred predominantly in areas with mean velocities of 0.30-0.70 ft/second and at depths of 2.00-2.40 ft, whereas steelhead occupied habitats with mean velocities of 0.40-0.80 ft/second and depths of 0.30-0.50 ft. In October, subyearling coho salmon were found in areas with mean velocities of 0.00-0.30 ft/second and at depths of 1.50-2.80 ft while steelhead occurred at depths of 0.60-1.20 ft where mean velocities were 0.10-0.80 ft/second. Subyearling coho salmon occurred over gravel-cobble substrates during both seasons, whereas steelhead were found in areas with substrate material of larger sizes in the autumn. Observed seasonal differences in the habitat and flow preferences of both species were completely masked when the data were pooled to yield a single estimate for depth and mean velocity. Variations in the probability-of-use for these habitat parameters may be related to seasonal differences in fish size and the physical characteristics of the streams. (Author's abstract)
W86-00590

WHOLE-LAKE FERTILIZATION EXPERIMENTS IN COASTAL BRITISH COLUMBIA LAKES: EMPIRICAL RELATIONSHIPS BETWEEN NUTRIENT INPUTS AND PHYTOPLANKTON BIOMASS AND PRODUCTION,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
For primary bibliographic entry see Field 5C.
W86-00603

DEPTH DISTRIBUTION AND BIOMASS OF SUBMERSED AQUATIC MACROPHYTE COMMUNITIES IN RELATION TO SECCHI DEPTH,
McGill Univ., Montreal (Quebec). Dept. of Biology.
P. A. Chambers, and J. Kalff.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 701-709, April, 1985. 6 Fig, 5 Tab, 38 Ref.

Descriptors: *Water depth, *Macrophytes, *Biomass, *Opacity, Aquatic plants, Submerged plants, Eutrophication, Solar radiation, Charophytes, Angiosperms, Bryophytes, Water temperature, Lakes, Trophic levels, Nutrients, Wave action, Substrate, Water currents.

Increased nutrient loading into many lakes during the past yr has led to pronounced changes in both the depth distribution and standing crop of submerged aquatic plants. Although changes in the growth of aquatic macrophyte communities are clearly correlated with lake eutrophication, it is not known how much macrophyte biomass will increase or how much the depth of macrophyte colonization will shift in response to changes in lake trophy. Regression models were developed that allow prediction of the maximum depth of macrophyte colonization for angiosperms, bryophytes, and charophytes and the depth of maximum angiosperm biomass from mean summer Secchi depth. Irradiance over the growing season at the maximum depth of colonization was about 1800 L/sq cm (1 cal/sq cm = 0.239 J/sq cm) for angiosperms and bryophytes and 1200 J/sq cm for charophytes. These values represent, on average, 21 and 11% of the photosynthetically available radiation incident on the water surface. Changes in maximum angiosperm biomass were not correlated with Secchi depth. The depth distribution of aquatic macrophyte communities is primarily controlled by irradiance, but environmental parameters other than irradiance and nutrients are also important in determining maximum angiosperm biomass in individual lakes. Such environmental factors include wave action, currents, substrate particle size and stability, and temperature. (Moore-IVI)
W86-00606

POSTSETTLEMENT DIATOM SUCCESSION IN THE BAY OF QUINTE, LAKE ONTARIO,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W86-00609

NITROGEN, PHOSPHORUS, AND ORGANIC CARBON CYCLING IN AN ARCTIC LAKE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
S. C. Whalen, and J. C. Cornwell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 797-808, April, 1985. 9 Fig, 5 Tab, 41 Ref. NSF grants DPP79-00815 and DPP77-23475.

Descriptors: *Nitrogen, *Phosphorus, *Organic carbon, *Toolik Lake, *Alaska, Cycling nutrient, Arctic lakes, Water temperature, Lake sediments, Primary productivity.

Budgets for nitrogen, phosphorus, and organic carbon in Toolik Lake, Alaska, were assembled from data collected during 1977-81. The annual total organic carbon (TOC), total nitrogen (TN), and total phosphorus (TP) loads to the lake were 8557, 290, and 4.64 mmol/sq m. Inlet streams were the major source of nutrients to the lake, as direct precipitation provided only 1, 2, and 5%, respectively, of the annual TOC, TN, TP loads to the lake. Up to 30% of the annual N and P inputs to the lake from riverine sources occurred during the first 10 d of stream flow following breakup when cold water temperatures and snow-covered ice limited primary production. Due to the short water renewal time (0.5 yr), efficiency of nutrient retention was poor and 90, 82, and 70% of the annual TOC, TN, and TP inputs to the lake were discharged at the outlet stream. Regeneration within the water column supplied 40-66% and 68-78% of the N and P necessary for measured primary production. Yearly accumulation rates for C, N, and P in the sediment were about 220, 21.0 and 1.75 mmol/sq m. Phosphorus remineralized within the sediment was completely retained due to adsorption onto Fe oxide minerals in the oxidizing surface layer. Annual rates of release of C and N to the overlying water column were 110 and 11.5-22.2 mmol/sq m. Mass balance considerations showed no serious errors in estimates of any terms of the annual sediment and water column N, P, and organic C budgets. (Author's abstract)
W86-00611

SEDIMENT ACCUMULATION RATES IN AN ALASKAN ARCTIC LAKE USING A MODIFIED 210PB TECHNIQUE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
J. C. Cornwell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 809-814, April, 1985. 5 Fig, 1 Tab, 22 Ref. NSF grant DPP77-23475.

Descriptors: *Sediment accumulation, *Lead radioisotopes, *Toolik Lake, *Alaska, Arctic lakes, Manganese, Iron, Aluminum, Lake sediments.

Toolik Lake is located in the northern foothills of the Brooks Range, Alaska. Its watershed coverrs 65 sq km, while the lake covers 1.5 sq km. The lake is ice covered from late September to late June. Because of high concentrations of authigenic Mn and Fe oxides in surficial sediments from Toolik Lake, the normalization of depth and Pb-210 activity scales to the sediment Al content was used for sediment accumulation rate calculations; results are compared with the conventional Pb-210 dating technique. The flux of Pb-210 to the lake was very low (10 dpm/sq cm/yr), and excess Pb-210 is restricted to the top 5 cm of sediment. The whole lake sediment accumulation rate is about 2.7 mg/sq cm/yr and the sediments are little disturbed by physical or biological processes. Low rates of physical and chemical weathering are responsible for the low sediment accumulation rates. The short period of runoff, low annual rates of rainfall, and stabilization of soils by tundra vegetation result in low exports of particulate material to Toolik Lake. (Moore-IVI)
W86-00612

CRITIQUE OF THE INSTREAM FLOW INCREMENTAL METHODOLOGY,
Radiation Management Corp., Drumore, PA. Muddy Run Ecological Lab.
D. Mathur, W. H. Bason, E. J. Purdy, Jr., and C. A. Silver.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 825-831, April, 1985. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Instream Flow Incremental Methodology, *Habitat, *Fish populations, Biomass, Fish behavior, Ecological distribution, Reviews.

A review and reanalysis of the published literature show that several assumptions are violated in the application of the Instream Flow Incremental Methodology (IFIM) without consideration of the implications of so doing. The fundamental assumption of a positive linear relationship between 'potential available habitat' (WUA) and biomass of fish has neither been documented nor validated, particularly in warmwater streams. Absence of correlation precludes prediction of changes in fish populations. In some studies the test of this assumption appears to be equivalent to a calibration operation. The other assumption violated includes independent selection of habitat variables by fish. The presence of significant interaction among habitat variables can affect the stream flow recommendations. Another problem exists in application of Physical Habitat Simulation (PHABSIM); one WUA unit should not be interpreted as being equal to another in biological production or habitat value unless shown to be an exact replica. Several combinations of physical variables could give rise to the same amount of WUA, none of which may be correlated to the biomass of fish. The utilization, suitability, or preference curves should not be treated as probability functions; a rating of 1.0 is not equivalent to probability of 1.0. Care should be taken to distinguish between real behavioral preferences of fishes based on distributional occurrence from abundance (relative or absolute size) in a steam. (Author's abstract)
W86-00613

2I. Water In Plants

TABLES FOR ESTIMATING DAILY EVAPORATION RATES OVER CROPS USING TEMPERATURE, ELEVATIONAL AND LATITUDINAL DATA ONLY,
Cedara Research Inst., Pietermaritzburg (South Africa).
B. Clemence.
Report N 5/1982. 45 p, 1 Tab, 2 Append.

Descriptors: *Evapotranspiration, *Soil water, *Elevation, *Agricultural hydrology, *Irrigation, *Data collections, Natal, South Africa, Altitude, Climatic data, Hydrologic data collections, Temperature, Crop factor, Rainfall, Precipitation, Wind velocity.

Tables for estimating evaporation over crops using Linacre's method are given for a variety of climates between latitudes of 27-31 degrees south in South Africa. Factors considered are elevation, temperature statistics, and climate type. Wind speed may be incorporated if known. This is important in coastal areas. Crop factors (the ratio between potential evapotranspiration and evaporation from Class A pans) are given.
W86-00313

GROWTH AND WATER USE OF TALL FESCUE AS INFLUENCED BY SEVERAL SOIL DRYING CYCLES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
M. J. King, and L. P. Bush.
Agronomy Journal, Vol. 77, No. 1, p 1-4, January-February, 1985. 5 Fig, 21 Ref.

Descriptors: *Plant growth, *Water use, *Fescue, *Soil water, Water stress, Watering schedule, Water potential, Osmotic potential, Turgor.

Many investigations have studied various physiological processes using plants watered on a schedule with the effect of this watering schedule seldom considered significant. An understanding of the effect of watering frequency on growth and water use is required to understand water stress tolerance of tall fescue (Festuca arundinacea Schreb.). Experiments were designed to evaluate the effect of the watering schedule in greenhouse grown tall fescue on growth, water use, and meristem tissue water status. Growth and water use as well as water, osmotic, and turgor potential of the leaf meristematic region were measured on tall fescue seedlings that had been exposed to several Maury soil (a fine, mixed, mesic Typic Paleudalfs) drying cycles (stressed and daily watered). Growth, measured as leaf extension rate (LER), was greater for seedlings watered to field capacity every 4th day than daily watered seedlings when soil of both treatments was allowed to dry. No significant difference in water potential or osmotic potential was observed during the experiment, and the differential LER was not dependent on turgor potential of the meristematic area which was similar to both treatments. Water use was 50 to 100% higher in control seedlings during the first 48 h of a soil drying cycle than in stressed seedlings. After several soil drying cycles the enhanced growth of stressed plants increased as high as 280%, then declined over the next 24 days of daily watering to about 50% above the control. The enhanced LER did not result in greater shoot fresh weights, but, repeated soil drying depressed root development. Consequently, growth, water status, and water use by tall fescue plants during an experiment must be evaluated in terms of the plants prior water stress history. (Author's abstract)
W86-00459

ROW SPACING, PLANT POPULATION, AND WATER MANAGEMENT EFFECTS ON CORN IN THE ATLANTIC COASTAL PLAIN,
Agricultural Research Service, Florence, SC.
For primary bibliographic entry see Field 3F.
W86-00460

PHYSIOLOGICAL RESPONSE OF MEADOWFOAM TO CROP WATER DEFICITS,
Colorado State Univ., Grand Junction. Fruita Research Center.
For primary bibliographic entry see Field 3F.
W86-00461

SOYPHEN: SOYBEAN GROWTH STAGES MODELED FROM TEMPERATURE, DAYLENGTH, AND WATER AVAILABILITY,
Missouri Univ.-Columbia. Dept. of Atmospheric Science.
T. Hodges, and V. French.
Agronomy Journal, Vol. 77, No. 3, p 500-505, May-June, 1985. 6 Fig, 6 Tab, 23 Ref. NOAA grant NA-82-AA-H-00011.

Descriptors: *Soybeans, *Model studies, *Plant growth, *Daylength, *Air temperature, *Water availability, Water stress, Computers, Phenology, Climate, Rainfall.

The soybean plant (Glycine max L.) responds strongly to daylength and temperature in it phasic development. Daylength responses vary greatly between varieties. Under very dry conditions, water stress may also affect development. Attempts to develop physiologically based large area yield models for soybeans have been hampered by the lack of a growth stage model incorporating these responses and applicable to a wide geographic and climatic range. The objective of this work was to develop a physiologically based model to predict growth stage dates for soybeans for the widest possible range of maturity groups and geographic areas. A phenology model was developed and tested for soybean Maturity Groups I to V based on temperature, daylength, and water availability. Coefficients were also developed, but not tested independently for Maturity Groups 00, 0, and VI to IX. Coefficients for Maturity Groups I to V were developed from 3 years (1971 to 1973) of data with five planting dates per year collected at Columbia, MO. The coefficients were tested on data sets taken at the same time at Spickard and Mt. Vernon, MO and on data for the 1981 season from 22 international sites. The test results indicate that the model will generate reliable estimates of soybean growth stages over a wide range of climatic conditions. The coefficients for Maturity Groups 00, 0, and VI to IX were developed from data from international sites, but no data were available for independent testing. The model is available in the FORTRAN and PL/I programming languages. It is suitable for incorporation into a soybean growth simulation model or for running as an independent crop calendar model. The model may be run wherever daily maximum and minimum temperatures and rainfall are available. (Author's abstract)
W86-00462

NITROGEN- AND WATER-USE EFFICIENCY OF SEVERAL COOL-SEASON GRASSES RECEIVING AMMONIUM NITRATE FOR 9 YEARS,
Nebraska Univ.-Lincoln.
J. F. Power.
Agronomy Journal, Vol. 77, No. 2, p 189-192, March-April, 1984. 1 Fig, 7 Tab, 11 Ref.

Descriptors: *Water-use efficiency, *Ammonium nitrate, *Grasses, Fertilizers, Plant growth, Nitrogen, Root growth, Drought, Water use.

Comparative information is needed on differences between grass species regarding dry matter production, root growth, water use, and response to N fertilization, as affected by both age of stand or years of N fertilization. The research reported was conducted on a Temvik silt loam (fine-ailty, frigid, mixed Typic Haploboroll) at Mandan, ND. Ammonium nitrate was surface broadcast at 0, 45, or 225 kg N/ha for 9 years on established stands of western wheatgrass (Pascopyrum smithii Rydb.(Love)), crested wheatgrass (Agropyron desertorum (Fish. ex Link) Schult.), intermediate wheatgrass (Elytrigia intermedia (Host) Nevski), smooth bromegrass (Bromus inermis Leyss.), Russian wildrye (Psathyrostachys juncea (Fisch.) Nevski), green needlegrass (Stipa viridula Trin.), and Garrison creeping foxtail (Alopecurus arundinaceus Poir). Dry matter production was usually greatest for E. intermedia. Production for B. inermis, P. smithii, and A. desertorum averaged 85 to 90% that of E. intermedia, and about 65 to 72% for the other species. Dry matter production for all species was generally doubled by 45 kg N/ha, and increased three-to fourfold with 225 kg N/ha. At 45 kg N/ha, N-use efficiency varied from an average of 51 kg dry matter per kg N for E. intermedia to 22 for Ps. juncea. Corresponding values at 225 kg N/ha dropped to 16 and 12 kg/kg N. Root dry weights were generally increased 50 to 100% by both N rates, but consistent differences among species were not evident. Annual water use was increased about 20 mm by fertilization, except in extreme drought years. Water-use efficiency (WUE) was also increased about threefold by fertilization, ranging from 22.6 kg/mm for fertilized E. intermedia to 3.2 for nonfertilized Al. arundinaceus. Water-use efficiency was highly correlated with dry matter production, increasing about 2.8 kg/mm for each 1000 kg/ha increase in production, with no effect of species, time, or N fertilization. (Author's abstract)
W86-00463

RESPONSE OF SELECTED SOYBEAN CULTIVARS TO SOIL MOISTURE DEFICIT,
Missouri Univ.-Columbia.
E. A. Brown, C. E. Caviness, and D. A. Brown.
Agronomy Journal, Vol. 77, No. 2, p 274-278, March-April, 1984. 8 Tab, 15 Ref.

Descriptors: *Water stress, *Water deficit, *Soybeans, Crop yield, Cultivars, Plant growth, Soil water, Irrigation.

Moisture is a major factor limiting yield in most areas where soybeans are grown. Moisture stress experiments were conducted under field conditions using four determinate soybean cultivars of Group VI maturity, in 1980 and 1981 on a Captina silt loam at Fayetteville, AR. The experiments consisted of two moisture stress treatments which were

initiated at the R2 and R4 growth stages and a control which was irrigated as needed throughout the season. Measurements were made on both roots and aboveground plant parts. When a moisture deficit was initiated by placing black plastic over the plots at either R2 or R4, seed yield was significantly reduced both years. A moisture deficit following application of plastic of R2 reduced yield more than at R4 in 1981, but the reverse was found in 1980, an extremely dry year. A moisture deficit initiated at R4 significantly reduced seed size and seed number both years whereas seed size was not significantly reduced either year by deficits initiated at R2. The cultivar Sohoma produced significantly larger seeds than the other three cultivars when plants were moisture stressed at R4. No significant cultivar x moisture stress interactions involving seed yield were observed in either year; however, there was a definite trend for seed yields of Sohoma to be reduced less by moisture deficits initiated at stage R4 in both 1980 and 1981. Percent flower and pod shedding did not appear to be affected to any great extent by the moisture stress treatments in either year. Flower production and shedding apparently are not important factors causing yield reductions under soil water deficits in these experiments. Moisture stress appeared to reduce root density under the row at both growth stages. Soybean cultivars differ to some extent in their response to soil moisture deficits, but these differences generally are small and not consistent in different environments. (Moore-IVI)
W86-00465

RELATIONSHIPS BETWEEN CROP WATER STRESS INDEX AND ALFALFA YIELD AND EVAPOTRANSPIRATION,
New Mexico Agricultural Experiment Station, Las Cruces.
A. S. Abdul-Jabbar, D. G. Lugg, T. W. Sammis, and L. W. Gay.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 454-461, March/April, 1985. 4 Fig, 7 Tab, 24 Ref.

Descriptors: *Evapotranspiration, *Water stress, *Crop yield, *Alfalfa, Evaporation, Transpiration, Water loss, Canopy temperature, Aerodynamic resistance,.

Two methods of determining Crop Water Stress Index (CWSI) were compared for alfalfa. The first method was the graphic method of Idso using the temperature differential between canopy and air. A significant relationship was obtained between evapotranspiration (E) and potential evaporation (Ep). The second method uses energy balance considerations to determine CWSI. Aerodynamic resistance r(a), which is needed to calculate CWSI, was evaluated using three different methods. The wind profile method overestimated r(a) and, accordingly, underestimated CWSI. The CWSI estimated using this method was not well correlated with measured E/Ep or dry forage yield. Overall, the CWSI concept provided a good indicator of alfalfa evapotranspiration and yield, and has potential to be used in irrigation scheduling. Values of CWSI can be determined rapidly using an infrared thermometer or using meteorological data. (Baker-IVI)
W86-00468

TRANSPIRATION RATE AND WATER USE EFFICIENCY OF SOYBEAN LEAVES ADAPTED TO DIFFERENT CO2 ENVIRONMENTS,
Florida Univ., Gainesville. Dept. of Agronomy.
For primary bibliographic entry see Field 2D.
W86-00483

RESPONSES OF C4 GRASSES TO ATMOSPHERIC CO2 ENRICHMENT. II. EFFECT OF WATER STRESS,
Duke Univ., Durham, NC. Dept. of Botany.
N. Sionit, and D. T. Patterson.
Crop Science, Vol. 25, No. 3, p 533-537, May/June, 1985. 4 Fig, 26 Ref. NSF grants DEB78-23640 and DEB80-21312.

Descriptors: *Water stress, *Grasses, *Carbon dioxide, Conductance, Photosynthesis, Stomatal transpiration, Leaves, Water potentials.

Water relationships and photosynthetic and stomatal responses of four different species of C4 grasses to increases in atmospheric CO2 concentration under water stress conditions were studied. Water and osmotic potentials of the leaves of the plants grown at both CO2 levels declined slowly for 3 to 6 days after watering ceased, then declined more rapidly toward the end of the stress period. The rate of decline in leaf water potential and the minimum values reached at the end of the stress cycle differed among the species. Leaf water potentials of the plants grown at the high CO2 concentration declined more slowly and maintained higher values at the end of the stress period than those of plants grown at low CO2 concentration. Osmotic potentials also declined more in the leaves of plants grown at low CO2 than in those grown at high CO2. Plants grown at high CO2 maintained a more positive turgor pressure at the end of the stress cycle than the plants grown at low CO2 concentration. The minimum leaf turgor pressure attained during water stress in these studies varied among species and was different at different CO2 concentrations. Wilting was observed only in one species grown at 350 micromol/mol CO2. High CO2-grown plants had greater net photosynthetic rates than low CO2-grown plants prior to water stress. There is presumably an adaptive advantage to high CO2-grown plants in maintaining higher leaf water potential under water stress conditions. Under the conditions of water stress, the stomata of the four C4 species grown in high CO2 do not change significantly but the leaves maintain greater turgor and higher net photosynthetic rates compared to those of the low CO2-grown plants. (Baker-IVI)
W86-00484

POTENTIAL FOR USING LEAF TURGIDITY TO SELECT DROUGHT TOLERANCE IN COTTON,
Agricultural Research Service, Lubbock, TX. Plant Stress and Water Conservation Research Unit.
J. E. Quisenberry, C. W. Wendt, J. D. Berlin, and B. L. McMichael.
Crop Science, Vol. 25, No. 2, p 294-299, March/April, 1985. 2 Fig, 5 Tab, 17 Ref.

Descriptors: *Drought resistance, *Leaves, *Turgidity, *Cotton, Water potential, Water stress, Photosynthesis, Water use efficiency, Biomass, Conductance, Wilting.

A comparison was made of growth rates, physiological responses, and seed cotton yield under water stressed field conditions between cotton strains that differed in ability to maintain leaf turgidity under dry field conditions. The observed variability in leaf turgidity among cotton germplasm is potentially useful in the development of drought tolerant germplasm. The nonflowering, nonwilting T25 strain produced more shoot biomass than did the nonflowing, wilting T169 strain under water deficit field conditions, and under glass house conditions, T25 produced more biomass per unit of transpired water than did T169. When genes for the day-neutral flowering response from Lubbock Dwarf were introgressed into the two strains, populations and selected lines showed a significant yield advantage for the T25 germplasm over the T169 germplasm under water deficit field conditions. The physiological data suggest that T25 reduces water loss under optimal water conditions through reduced leaf conductances which allows T25 to use this saved water to keep its stomata partially open longer and thus fix C and grow longer when seasonal soil water is limited. (Baker-IVI)
W86-00486

COMPARATIVE EFFECTS OF REPEATED CYCLES OF WATER STRESS ON GROWTH AND APPARENT DINITROGEN FIXATION OF LADINO AND STRAWBERRY CLOVERS,
California Univ., Davis. Dept. of Agronomy and Range Science.
K. L. Johnson, and C. A. Raguse.
Crop Science, Vol. 25, No. 2, p 299-306, March/April, 1985. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Water stress, *Plant growth, *Crop yield, Soil water, Drought, Leaves, Water potential, Nitrogen fixation, Temperature effects.

The effects of repeated short-term cycles of soil moisture depletion on canopy temperature, leaf water potential, and nodule hydration as indicators of plant stress were examined. The relationship between repetitive short-term water stress (10 hr visible wilting) and apparent N2 fixation and maintenance of vegetation growth was determined. The response to stress can be generalized in at least three categories. First, responses which result from diurnal, cyclic changes in the environment; second, similar responses which are demonstrated over a period of 2 to several days but are reversible; and third, longer-term responses which are derived from integration of effects of combined and/or repeated short-term influences. Daily variation in the differential between canopy and air temperature provided an example of the first stress response. Short term, cyclic fluctuations in leaf water potential, nodule hydration, and acetylene reduction activity demonstrated the second, and decreases in total plant dry matter and N, as well as decreased accumulation of leaf and stolon growth, exemplified the third. Results of the ladino and strawberry clover experiments suggest that if stress events of moderate (reversible) impact are repeated at close intervals, resultant longer-term reductions in growth can lower above-ground production of stem and leaf tissue by as much as 40% within time periods equivalent to a typical hay production or pasture rotation cycle. (Baker-IVI)
W86-00487

EFFECTS OF N FERTILITY ON PLANT WATER RELATIONS AND STOMATAL RESPONSES TO WATER STRESS IN IRRIGATED COTTON,
Agricultural Research Service, Phoeniz, AZ. Western Cotton Research Lab.
J. W. Radin, J. R. Mauney, and G. Guinn.
Crop Science, Vol. 25, No. 1, p 110-115, January/February, 1985. 5 Fig, 3 Tab, 19 Ref.

Descriptors: *Crop yield, *Water stress, *Irrigation practices, *Water use efficiency, *Cotton, Leaves, Water potentials, Stomatal transpiration, Conductance, Osmotic pressure.

The effects of N fertility on water relations and stomatal behavior of irrigated cotton in the field were explored and those effects were compared to effects on yield and water use efficiency (WUE). High levels of N caused stomata to remain open to very low osmotic potentials in irrigated cotton during the early part of the fruiting cycle, but this effect was lost as the season progressed. In July, stomata of high-N plants closed at an osmotic pressure considerably below the wilting point. In September, closure occurred much closer to the wilting point. In low-N plants, stomatal closure was more closely associated with the wilting point throughout the season. The changing stomatal behavior of high-N plants was apparently related to petiole NO3-N levels but not to total leaf N. The effects of low N on plant water relations and water use were such that 10-cm irrigations produced as much yield as, and a higher WUE than, 15 cm irrigations. (Baker-IVI)
W86-00488

SIMULATION OF MOISTURE STRESS EFFECTS ON SOYBEAN YIELD COMPONENTS IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
G. E. Meyer.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 118-128, January/February, 1985. 6 Fig, 7 Tab, 46 Ref.

Descriptors: *Water stress, *Crop yield, *Soybeans, *Nebraska, Simulation, SOYMOD/OARDC, Model studies, Irrigation effects, Plant growth, Overwatering.

The most recent improvements and modifications to the model SOYMOD/OARDC are described

along with explanations of how the model can be used to study water stress interactions with soybeans. A sensitivity study is provided involving different weather sequences to simulate how the soybean crop responds to these conditions. Supplemental water can be applied to an indeterminant soybean crop based on soil moisture depletion during the critical stages of reproductive growth (podfill) to reduce moisture stress during these periods. The simulations suggest that there can be a number of complicating factors for achieving large soybean seed yields with irrigation. Overwatering or large water supply during vegetative stages may elicit competitive response of the leaves for nitrogen with later fruit development which may result in smaller size fruit. Optimization analyses should be applied to determinate soybean irrigation studies to determine when to apply water that will elicit a significant yield response. As the physiological system becomes better quantified, computer simulation will play an important role in these optimization studies. Some of the new features and capabilities of REALSOY have been demonstrated for research and teaching activities. The model is quite flexible and upgradable. It can give fast estimates of soybean seed size and yield or generate a complete analysis of physiological data at the console. (Baker-IVI)
W86-00491

COTTON PLANT RESPONSE TO WIND AND WATER STRESS,
Agricultural Research Service, Lubbock, TX. Cropping Systems Research Service.
G. L. Barker, J. L. Hatfield, and D. F. Wanjura.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 194-200, January-February, 1985. 6 Fig, 4 Tab, 16 Ref.

Descriptors: *Cotton, *Wind, *Water stress, Crop yield, Phenology, Shelter, Water use, Air temperature, Regression equations.

Cotton plant phenology was observed in a sheltered environment for six different planting dates and compared to cotton grown in an unsheltered area. The shelters consisted of a snow fence and provided a 35% reduction in wind velocity 0.2 m above the crop for the season. Increased plant height, earlier squaring, earlier boll set and more bolls and biomass were observed for sheltered cotton when compared to the unsheltered cotton. The unsheltered cotton used less water than the sheltered cotton. Regression equations were developed to predict plant height and the change in plant height as a function of age of the plant, wind movement, daytime temperature and nighttime temperature. (Author's abstract)
W86-00503

WATER USE EFFICIENCY IN A SOYBEAN FIELD: INFLUENCE OF PLANT WATER STRESS,
National Oceanic and Atmospheric Administration, Oak Ridge, TN. Air Resources Atmospheric Turbulence and Diffusion Lab.
D. D. Baldocchi, S. B. Verma, and N. J. Rosenberg.
Agricultural and Forest Meteorology, Vol. 34, No. 1, p 53-65, February, 1985. 6 Fig, 3 Tab, 41 Ref. Regional Research Project 11-33 and Nebraska Agricultural Experimental Station Project 11-049.

Descriptors: *Water use efficiency, *Soybeans, *Water stress, Photosynthesis, Evapotranspiration, Carbon dioxide, Stomatal resistance, Soil water, Plant water potential, Leaves.

Measurements were made in 1980 over a fully-developed soybean (Glycine max (L.) Merrill) canopy at Mead, Nebraska to determine how crop water status influences photosynthesis, evapotranspiration and water use efficiency. Water use efficiency was calculated in terms of the CO2-water flux ratio (CWFR). Micrometeorological techniques were used to measure the exchange rates of CO2 and water vapor above the crop canopy. Crop water status was evaluated by reference to volumetric soil moisture (theta sub v), stomatal resistance (r sub s), and leaf water potential (psi) measurements. Stomatal resistance (r sub s) was independent of psi when the latter was greater than -1.1 MPa; r sub s increased sharply as psi dropped below this threshold. Canopy CO2 exchange (F sub c) decreased logarithmically with increasing r sub s under strong irradiance. Although Fc was found to be strongly correlated with r sub s, the influence of low values of psi and of high air temperature cannot be discounted since these factors affect the enzymatic reactions associated with photosynthesis. Stomatal closure also reduced evapotranspiration and influenced the partitioning of net radiation. Under strong irradiance the CO2 water flux ratio (CWFR) decreased with increasing stomatal resistance. This observation is at variance with predictions of certain early 'resistance' models, but substantiates predictions of some recent models in which leaf energy balance considerations are incorporated. (Author's abstract)
W86-00505

EVALUATING PLANT AND CANOPY RESISTANCES OF FIELD-GROWN WHEAT FROM CONCURRENT DIURNAL OBSERVATIONS OF LEAF WATER POTENTIAL, STOMATAL RESISTANCE, CANOPY TEMPERATURE, AND EVAPOTRANSPIRATION FLUX,
National Aeronautics and Space Administration, Greenbelt, MD. Hydrological Sciences Branch.
B. J. Choudhury, and S. B. Idso.
Agricultural and Forest Meteorology, Vol. 34, No. 1, p 67-76, February, 1985. 7 Fig, 25 Ref.

Descriptors: *Plant water potential, *Stomatal resistance, *Canopy temperature, *Evapotranspiration, *Wheat, Leaves, Diurnal variation, Soil water, Transpiration, Mathematical equations.

Concurrent observations of leaf water potential, stomatal diffusion resistance and canopy temperature were made on two plots of wheat (Triticum aestivum L. cv. Anza) growing at Phoenix, Arizona under two different soil water conditions. These data were further complemented by weather observations and lysimeter measurements of total evaporative water loss from the plots. Transpiration fluxes for each plot were estimated by an aerodynamic-energy balance approach and compared with the lysimeter data. Plant resistances were computed from the transpiration flux results and the leaf water potential measurements using van den Honert's equation, while canopy resistances were also computed from the transpiration flux using Monteith's equation. The calculated plant resistance decreased by a factor of almost two from morning to mid-afternoon whereas the ratio of canopy and stomatal resistance was constant during most of the day. (Author's abstract)
W86-00506

YIELD, COMPOSITION AND QUALITY OF TALL FESCUE AS INFLUENCED BY N FERTILITY AND SOIL WATER AVAILABILITY,
Russell Research Center, Athens, GA.
D. P. Belesky, S. R. Wilkinson, and F. McHan.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 8, p 945-968, July, 1984. 10 Tab, 20 Ref.

Descriptors: *Fescue, *Crop yield, *Water stress, *Nitrogen, *Fertilizers, Soil water, Forages, Plant growth, Leaves, Stomatal resistance, Transpiration, Toxicosis.

A study was designed to evaluate yield, quality and composition of tall fescue (Festuca arundinacea Schreb.) as influenced by water stress under 0, 100, and 400 kg N/ha during autumn in the southeastern U.S. Four replicates of each treatment were imposed in a completely random design in the field. The experiment was conducted in two successive years with treatments applied to an adjacent area to eliminate residual or carry-over effects. Water status was verified by gypsum block, tensiometer, and determination of leaf stomatal resistance. Plant tissue was harvested three times during autumn and again in the following spring. Forage yield total was not significantly affected by soil water stress, apparently due to compensatory growth during recovery periods. Soil water appeared to be more rapidly depleted under 400 kg N/ha than other N treatments. Increasing N fertilizer significantly increased leaf area, leaf number, and was inversely related to the number of senesced leaves. Stomatal resistance was increased under water stress conditions when N was limited (ON) but not when 400 kg N/ha was applied. Consequently, plots receiving 400 kg N/ha continued to transpire even during periods of limited soil water, but transpired less during subsequent stress periods. Kjeldahl and NO3-N were increased by application of fertilizer N and only NO3-N was significantly increased by water stress in this study. Although high input of fertilizer N minimized the impact of mild water stress on the physiological response of tall fescue, eventual stand loss occurred. Water stress had no effect upon nonstructural carbohydrates, in vitro dry matter digestibility or the elements P, K, Ca, Mg, Cu and Zn. Consequently the factors associated with the expression of tall fescue toxicosis during autumn are more subtle in expression, and do not appear to be associated with alterations in major nutritive components. (Author's abstract)
W86-00512

WATER RELATIONS IN XEROPHYTIC PLANTS (VODNI PROVOZ SUCHOMILNYCH ROSTLIN),
Vysoka Skola Zemedelska, Brno (Czechoslovakia). Faculta Lesnicka.
M. Penka.
Acta Universitatis Agriculturae (Brno) Series C (Facultas silviculturae), Vol. 52, No. 3-4, p 243-257, 1983. 5 Fig, 34 Tab.

Descriptors: *Xerophytes, *Water relation, Transpiration, Drought resistance, Succulents, Halophytes, Soil-water-plant relationships, Roots, Shoots, Plant physiology.

The objective was to study the water relations in xerophytic plants. The term 'xerophytes' was defined and a classification of the plants suggested (sclerophilous, malacophilous, stenohydric, eurihydric, hydrostable, hydrolabile plants). Attention was also given to division of the plants as based on the depth of rooting with respect to their water intake and outgo (water balance). Moreover, the root:shoot (R/S) ratio was evaluated, account being taken of the anatomy of vascular bundles and their conductivity. As for the water relations in the shoot system, further essential features were assessed, primarily the conduction and outgo of water in relation to anatomical characteristics of vascular bundles and to anatomical structure of leaves, of assimilating stems. The Schimper theory on xerophytism was confronted with Maximoff's views of xerophytes approached from the physiological standpoint. The difference between transpiration and resistance of plants against drought was discussed in detail; high resistance against drought was found to be a feature characteristic of all xerophytes. The observations indicated that xerophytes, if supplied well by water, either equalled to or exceeded the transpiration of mesophytes and hygrophytes. Basing on the ability to resist the impact of drought, xerophytes would be divided into following categories: annual, sclerophilous evergreen, xeromorphous leafless, perennial deciduous, reducing transpiration area during the spell of dry weather, and succulent. The last category of xerophytes was subdivided into leaf succulents, stem succulents, and underground succulents. Since halophytes stand near xerophytes, the oligotrophic plants into which halophytes are usually included were classified first. Of individual features of the water relations were discussed mainly: water outgo, osmotic conditions, and physiological drying. The terms 'hygrohalophytes' and 'xerohalophytes' were also mentioned, in relation to variations in the soil moisture and salts. (Author's abstract)
W86-00592

SOIL-PLANT-WATER MODEL WITH A CASE STUDY IN A FORESTED CATCHMENT,
Centre National de la Recherche Scientifique, Toulouse (France). Centre d'Ecologie des Ressources Renouvelables.
T. Huillet, and J. Lauga.
Ecological Modelling, Vol. 27, No. 3/4, p 235-250,

April, 1985. 8 Fig, 2 Tab, 25 Ref.

Descriptors: *Water use, *Plants, Model studies, Forest watershed, Catchment areas, Hydrologic models, Water budget, Evaporation, Transpiration, Mathematical models.

A model is presented to sketch the mean features of soil-plant-atmosphere interactions. Many earlier studies have been interested in mathematical modelling of water cycling in small watersheds. Among so called conceptual models of processes there is a distinction between spatial models taking into account some aspects of spatial heterogeneity and lumped models such as the CREC model. The main features of the CREC model are described. The dynamic model proposed covers a period of 1 year, and the spatial unit chosen is a forested catchment area. The transpiration process is shown to differ from evaporation over a water surface as soon as a water deficit develops, corresponding to the closure of stomata and a sharp reduction in transpiration, although the evaporative power of the air may still be strong. The mathematical model is first discussed with reference to hydrological processes over the watershed, followed by the addition of state equations which describe the living part of the watershed and its water consumption processes. The ability of the soil-plant-atmosphere model presented to separate transpiration and evaporation rates makes it possible to grasp some characteristics of the daily evolution of these variables. The calibration is not yet reliable enough but it provides a useful guide for future data collection. Some variables, such as mean daily leaf water potential, are biologically ill-defined. To improve the model optimization should be possible, although it should be noted that the uniqueness of the solution is not guaranteed with scarce data usually found in ecology. (Baker-IVI)
W86-00595

CANOPY DYNAMICS OF EUCALYPTUS MACULATA HOOK. III; EFFECTS OF DROUGHT,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
E. W. Pook.
Australian Journal of Botany, Vol. 33, No. 1, p 65-79, 1985. 8 Fig, 4 Tab, 26 Ref.

Descriptors: *Drought, *Eucalyptus, *Canopy, New South Wales, Leaf-shedding, Wilting, Bark-splitting, Defoliation, Drought resistance, Trees, Water deficit.

The severe 7-month drought in coastal and adjacent tablelands regions of New South Wales in the latter half of 1980 caused heavy leaf-shedding, wilting of persistent foliage and bark-splitting in forest eucalypts. Defoliation of individual sample trees of Eucalyptus maculata ranged from 50 to 97% of pre-drought leaf area. Leaf area index of a stand of E. maculata was reduced from c. 4.3 to 0.8. E. maculata was less susceptible to drought than E. globoidea and E. pilularis but more susceptible than E. paniculata in mixed forest on the same site. Rapid recovery of the canopy occurred in autumn after the break of the drought and leaf areas of all sample trees attained pre-drought values or above by summer 1981-82. Leaf-shedding in response to severe water deficit appears to have been of adaptive significance in enhancing tree survival in a drought of this duration. (Author's abstract)
W86-00596

2J. Erosion and Sedimentation

HYDROLOGY, HYDRAULIC, AND SEDIMENT CONSIDERATIONS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 6G.
W86-00336

EFFECTS OF SOIL EROSION ON SOYBEAN YIELDS AND CHARACTERISTICS OF CECIL-PACOLET SOILS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. White, R. R. Bruce, A. W. Thomas, G. W. Langdale, and H. F. Perkins.
Erosion - Productivity Investigations, 1982-83, Research Report No. IRC 060184, June 1984. 36 p, 11 Fig, 11 Tab.

Descriptors: *Soil erosion, *Erosion, *Crop production, *Crop yield, *Soybeans, *Georgia, *Plant growth, Baseline studies, Soil water, Piedmont, Rainfall, Growth, Data collections, Infiltration, Soil horizons, Potassium, Magnesium, Phosphorus, Minerals, Soil conservation.

Cooperative studies on 24 farm fields over a seven-county area in the Southern Piedmont of Georgia were conducted in 1982 and 1983 to evaluate the effects of soil erosion on soybean growth and production. Replicated plots were established on Cecil-Pacolet soils in slightly, moderately, and severely eroded areas in each field. Severely eroded soils had markedly lower levels of P compared to slightly eroded soils, while K and Mg were lowest on slightly eroded areas. Erosion reduced plant growth, yields, and stands. In 1982, bean yields averaged 41.3, 28.1, and 19.8 bushels/acre for the slightly, moderately, and severely eroded areas. Analysis of rainfall data for both years showed a 2.7 bushel/acre yield increase per inch of rainfall on the slightly eroded soils. Soil water studies in 1982 showed that slightly eroded sites were well supplied with water more than 40% of the time, compared with 29 and 27% of the time on moderately and severely eroded sites, respectively. These results suggest that there is less infiltration of rainfall into eroded soils, and increased rainfall does not necessarily increase yields on eroded soils. These findings also indicate that erosion is a very serious problem on Southern Piedmont soils and can cause drastic reduction in crop yields.
W86-00339

EFFECTS OF SOIL EROSION ON SOYBEAN PRODUCTION IN THE SOUTHERN PIEDMONT OF GEORGIA IN 1982,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 4C.
W86-00340

PHOTOGRAMMETRIC TECHNIQUES FOR MONITORING SOIL EROSION,
Georgia Univ., Athens. Dept. of Geography.
R. Welch, T. R. Jordan, A. W. Thomas, and J. W. Ellis.
Photogrammetry - Soil Erosion Investigations 1983, Research Report No. IRC 09083, September, 1983. 22 p, 6 Fig, Tab 1, 5 Ref.

Descriptors: *Monitoring, *Soil erosion, *Photogrammetry, *Photography, *Aerial photography, *Channel erosion, *Gully erosion, *Bank erosion, Soil conservation, Erosion rates.

The potential of photogrammetric techniques for monitoring soil erosion is described along with the work accomplished by the USDA-ARS Southern Piedmont Conservation Research Center and the University of Georgia between March 1982 and September 1983. Photogrammetry can be used to obtain highly accurate X, Y, and Z terrain coordinates of fragile erosion surfaces recorded on stereo photographs. Analog photogrammetric techniques usually require the use of costly stereo-plotters and the services of a trained photogrammetrist. Analytical photogrammetric techniques involve the measurement of image coordinates and their transformation into X,Y,Z terrain coordinates by computational procedures. Four sites on the Southern Piedmont Conservation Research Center property near Watkinsville, Georgia are being monitored by sequential photogrammetry for stream channel erosion, roadbank-type erosion, gully formation and field erosion, respectively. Further work is needed on the use of aerial photography in conjunction with photogrammetric methods to monitor the topographical changes of larger areas.
W86-00342

BEACH CHANGES AT NAUSET INLET, CAPE COD, MASSACHUSETTS: 1670-1981,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2L.
W86-00379

FACTORS INFLUENCING INORGANIC TURBIDITY IN A GREAT PLAINS RESERVOIR,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00440

SEDIMENT LOSSES FROM CROPLAND FURROWS OF DIFFERENT GRADIENTS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. D. Meyer, and W. C. Harmon.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 448-461, March/April, 1985. 3 Fig, 6 Tab, 23 Ref.

Descriptors: *Sedimentation, *Erosion, *Soil loss, *Furrows, Cropland, Gradients, Simulated rainfall, Slope, Rill erosion, Rainfall, Runoff.

Soil losses from fields with bedded or ridged rows depend greatly on the row-furrow gradient and row length. Bedded rows with furrow gradients ranging from 0.5 to 6.5% were subjected to a series of simulated rainstorms. Erosion from the row sideslopes was the same at all furrow gradients. Furrow losses increased rapidly between 0.5 and 2.0% gradient, increased only slightly from 2.0% to 5.0%, and again increased rapidly between 5.0 and 6.5%. Losses increased more than 5 times as intensity was increased from 26 to 70 mm/h intensity and more than doubled again from 70 to 108 mm/h. When longer rows were simulated by adding inflow to the furrows, soil losses increased only slightly faster than furrow length until major rilling began. Computation of USLE slope length exponents along the furrows gave values of about 0.1 at 0.5% gradient and near 0.2 at 2.0% and 3.5%. All sediment lost from 0.5% furrows eroded from the row sideslopes. For furrows of 2.0, 3.5, and 5.0% at lengths less than 30 m, more of the lost sediment eroded from the row sideslopes than from the furrows. More of the sediment lost at 6.5% gradient eroded from the furrows for lengths greater than 10 to 20 m. The clay sized portion of the total sediment lost from the furrows decreased as furrow gradient increased, although the amount of loss for this size was about constant unless rilling was serious. Some deposition of silt and sand sized sediment in the furrows occurred at 0.5% gradient, but all such sizes were transported at gradients of 2.0% and steeper. Sediment scoured by flow along steeper and longer furrows was predominantly silt and sand sized. (Baker-IVI)
W86-00467

FIELD EROSION ESTIMATED FROM 137CS ACTIVITY MEASUREMENTS,
Wisconsin Univ.-Madison. Dept. of Agricultural Engineering.
J. R. McHenry, and G. D. Bubenzer.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 480-496, March/April, 1985. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Cesium radioisotopes, *Soil erosion, *Estimating, Soil loss, Erosion control, Cultivation, White Clay Lake Watershed, Wisconsin, Fallout.

Soil samples were collected from fields and wooded sites in White Clay Lake Watershed, Wisconsin. The watershed consists of some 1100 ha of rolling land largely devoted to intensive agriculture. The cultivated fields sampled are farmed in an oats-alfalfa-corn rotation. Fallout Cs-137 concentrations in the soil pedons was used as a tracer or tag in studies conducted in this area in 1974 and 1976. In 1980, after 4 to 6 years of additional cultivation, the fields were again sampled and Cs-137 measured. The results demonstrate that a considerable movement of soils occurs within the cultivated fields. The fallout of Cs-137 was deemed

useful as a tracer of soil particle movement to estimate erosion rates and amounts of soil movement. A comprehensive within field budget of soil movement can be determined by using the Cs-137 procedure together with a grid of sampling sites. Estimates of transport of soil into and out of the field also can be made. These measurements can be made at any given time. Accuracy of the soil loss or gain measurements will depend on the accuracy of the determination of the base level of Cs-137 content and on the detail of the sampling grid of soil profiles. If desired, predetermined precision for each measurement of Cs-137 is possible by use of available nuclear counting techniques. (Baker-IVI)
W86-00472

ESTIMATING SOIL DETACHMENT CAUSED BY RAINDROP IMPACT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B.
W86-00494

INTERRILL SOIL EROSION - PART I: DEVELOPMENT OF MODEL EQUATIONS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. E. Gilley, D. A. Woolhiser, and D. B. McWhorter.
Transactions of the American Society of Agricultural Engineers, Vo. 28, No. 1, p 147-153 and 159, January/February, 1985. 4 Fig, 4 Tab, 34 Ref.

Descriptors: *Soil erosion, *Rain, *Interrill erosion, *Model studies, Mathematical equations, Sediment transport, Overland flow, Rainfall intensity.

Model equations were evaluated which are used to estimate interrill soil erosion. The equations developed serve to complement existing erosion models. The accuracy of comprehensive erosion models can be improved if more reliable formulas for predicting overland flow depth, soil detachment and sediment transport capacity are identified. The soil erosion process in the interrill overland flow range is governed by soil detachment from raindrop impact and the transport of soil materials by shallow overland flow. Both of these processes may be significantly influenced by depth of overland flow. Model equations are identified which include the effects of varying overland flow depth on soil detachment and transport. Overland flow depth was determined by the Darcy-Weisbach equation. The Darcy-Weisbach friction coefficient was estimated from an empirical relation including rainfall intensity and flow Reynolds number. A dimensionless equation was used to predict depths of overland flow for varying rainfall intensities and surface roughness. Soil detachment by raindrop impact was represented as the product of a soil detachment factor and the maximum impact pressure at the soil-water interface caused by raindrop impact. Impact pressure was estimated from an empirical equation involving drop impact velocity, drop diameter and water layer depth. Because raindrop size distribution, drop velocity and overland flow depth appear explicitly in the detachment equation, it may prove useful in evaluating results of erosion studies obtained using rainfall simulators with different raindrop characteristics. The sediment transport capacity of runoff was estimated as the product of a sediment transport factor, bottom shear stress and flow velocity. Bottom shear stress was represented as the product of specific weight of water, water depth and channel slope. This relation appeared to provide proper estimates of sediment transport capacity. The data base used to test the model equations was limited. As complex, individual erosion mechanisms become better defined, more reliable and comprehensive soil erosion models can be developed. (Baker-IVI)
W86-00495

INTERRILL SOIL EROSION - PART II: TESTING AND USE OF MODEL EQUATIONS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. E. Gilley, D. A. Woolhiser, and D. B. McWhorter.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 154-159, January/February, 1985. 11 Fig, 2 Tab, 7 Ref.

Descriptors: *Soil erosion, *Rainfall, *Interrill erosion, Rain, Intensity, Mathematical equations, Model studies, Shear stress, Slope, Sediment transport, Overland flow.

The effects of varying discharge and slope steepness on interrill soil erosion was measured. The previously identified model equations were tested on experimentally obtained information. The interrill overland flow range was identified and the influence of slope length on interrill erosion was examined. A rainfall simulator was used to measure interrill runoff and erosion under lab conditions for a Nunn clay loam soil. Discharge and slope steepness were included as experimental variables. Inflow was added at the top of the test section in a portion of the study to simulate greater slope lengths. Soil loss consistently increased with slope steepness when inflow was not added. Greater discharge rates, resulting from addition of inflow, caused larger erosion rates in some instances and reduced rates of erosion in others. In general, rilling was observed to occur at smaller discharge rates as slope steepness was increased. The experimentally obtained information was used to test previously identified model equations. In general, predicted soil loss rates agreed well with measured data. Analyses of experimental information collected in the present study suggest that previously identified detachment and transport relations are appropriate for estimating interrill soil erosion. The overland flow length required for establishment of critical shear stress is expected to change from a few meters to several hundred meters as slope gradient is decreased from 10 to 1%. Slope length affects interrill soil erosion because water depth increases with downslope distance. Water depth in turn influences soil detachment and overland flow sediment transport capacity. Soil erosion at a particular downslope distance is dictated by soil detachment or sediment transport capacity characteristics existing at that particular location. (Baker-IVI)
W86-00496

SOIL LOSS FROM COTTON WITH CONSERVATION TILLAGE,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 4D.
W86-00497

SEDIMENTATION IN A BLAST-ZONE LAKE AT MOUNT ST. HELENS, WASHINGTON - IMPLICATIONS FOR VARVE FORMATION,
New Mexico Univ., Albuquerque. Dept. of Geology.
R. Y. Anderson, E. B. Nuhfer, and W. E. Dean.
Geology, Vol. 13, No. 5, p 348-352, May, 1985. 3 Fig, 1 Tab, 18 Ref. NAF grant EAR 81-13072.

Descriptors: *Sedimentation, *Varves, *Coldwater Lake, *Washington, *Mount St. Helens, Volcanoes, Erosion, Vegetation, Sediment yield, Turbidites, Precipitation, Seasonal variation.

The basin that holds Coldwater Lake was formed when a debris avalanche from the May 18, 1980, eruption of Mount St. Helens, Washington moved down the Toutle River and blocked the confluence of Coldwater and south Coldwater creeks. The drainage area of the lake contains highly erodible materials. Vegetation was virtually absent from the devastated area after the eruption, and large areas of bare ground were still present at the time of the studies. Sediment collected from June 1982 through August 1984 in traps in the newly formed lake in the blast-impact area recorded a sediment yield that is about two orders of magnitude greater than for comparable basins with vegetation and similar precipitation. Most sediment was mobilized by storms and runoff at the onset of the wet season. The sedimentation response to strongly seasonal precipitation, in the absence of vegetation, produced turbidites and graded annual couplets. The seasonal shift from turbidite to nonturbidite deposition, followed by the slow accumulation of clay, was a consequence of the strongly seasonal distribution of precipitation. Texturally and structurally, the laminated and graded silt layer and the silt-clay couplets bear a close resemblance to some of the graded clastic varves forming in proglacial lakes. (Moore-IVI)
W86-00517

MODELLING OF 210PB BEHAVIOUR IN THE CATCHMENT AND SEDIMENT OF LAKE TALI KARNG, VICTORIA, AND ESTIMATION OF RECENT SEDIMENTATION RATES,
Melbourne Univ., Parkville (Australia). Marine Chemistry Lab.
J. D. Smith, and T. F. Hamilton.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 15-22, 1985. 2 Fig, 2 Tab, 22 Ref.

Descriptors: *Lead radioisotopes, *Lake sediments, *Lake Tali Karng, *Victoria, Sedimentation rate, Catchment area, Model studies.

Lake Tali Karng, the only natural deep-water highland lake in Victoria, Australia, is situated at an altitude of 915 m on the south side of the Victorian Alps. A sediment core was taken from the deepest part of the lake. The flux of unsupported Pb-210 to the sediment is about 145 mBq/sq cm/year. Over the last 100 years, about 75 cm of sediment has accumulated at an average rate of 150-200 mg/sq cm/year. Calculations using two models to convert Pb-210 activity-depth profiles to age-depth profiles indicate that the sedimentation rate has increased slightly over the last 100 years. It is estimated that about 14% of the Pb-210 falling in the catchment reaches the lake sediment, but depending on the assumptions made, the possible range is 7-60%. The contribution of Pb-210 from the catchment may be related to the rugged topography of the region, with some influence from the above-average uranium concentrations in the rocks. Lake Tali Karng with its unique environment is an excellent site for the study of the behavior of Pb-210 in a catchment and for development of models of relationships between different sources of Pb-210. (Moore-IVI)
W86-00520

SEDIMENTATION OF PARTICULATE MATERIAL IN NORDASVANNET, A HYPERTROPHIC, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
For primary bibliographic entry see Field 2L.
W86-00527

STATISTICAL MODELING OF HISTORIC SHORE EROSION RATES ON THE CHESAPEAKE BAY IN MARYLAND,
Naval Academy, Annapolis, MD. Dept. of Mathematics.
R. K. Spoeri, C. F. Zabawa, and B. Coulombe.
Environmental Geology and Water Science, Vol. 7, No. 3, p 171-187, 1985. 7 Fig, 8 Tab, 75 Ref.

Descriptors: *Statistial models, *Shore erosion, *Chesapeake Bay, *Maryland, Erosion rate, History, Storms, Tides, Waves, Littoral drift, Regressionn analysis, Discriminant analysis.

Few strong relationships exist along the Chesapeake Bay shoreline between the historic erosion rate and the distribution of any of several coastal parameters which were defined and tested using traditional regression and discriminant analysis procedures. To develop a simple predictive equation for shore erosion that could be used by coastal managers, the entire Chesapeake Bay shoreline was partitioned into naturally occurring reaches 2-5 km in length, and the historic erosion rate on each reach was modelled as a function of five variables: (a) shoreline type; (b) '100-year' storm surge height; (c) mean tidal range; (d) wave climate; and (e) potential littoral drift rate. The statistical analysis yielded a multiple correlation coefficient (r sq) of 30.8%; discriminant analysis showed only the first two variables listed above are useful predic-

tors (i.e., statistically significant) of historical erosion rates. A 95-mile portion of the same bay shoreline in Queen Anne's and Talbot counties was then partitioned into shorter reach lengths (1/2-2 km) and more variables were included. The multiple correlation coefficient (r sq) improved slightly to 32.9%, but only shoreline type and potential litoral drift rate were found to be useful predictors of historic erosion rates. Curiously, the ability to model statistically the historic shore erosion rate is best on those reaches already substantially protected by structures. For Queen Anne's and Talbot counties, the multiple regression coefficient improved to 61.5% when only reaches 1/2-2 km in length protected by structures were considered. (Author's abstract)
W86-00556

SEDIMENT ACCUMULATION RATES IN AN ALASKAN ARCTIC LAKE USING A MODIFIED 210PB TECHNIQUE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2H.
W86-00612

2K. Chemical Processes

MATHEMATICAL MODELING OF COMPLEX FORMATION OF METALS AND ITS APPLICATION TO THE INTERPRETATION OF PHYSICOCHEMICAL PROCESSES IN NATURAL WATERS (MATHEMATISCHE MODELLIERUNG DER KOMPLEXBILDUNG VON METALLEN UND IHRE NUTZUNG BEI DER INTERPRETATION PHYSIKOCHEMISCHER PROZESSE IN NATURLICHEN WASSERN),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
R. Fischer, and H. Reissig.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 3-18, 1984. 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Mathematical models, *Chemical complexation, *Metals, *Natural waters, Physicochemical properties, Ligands, Temperature, Hydrogen ion concentration, Iron, Oxidation.

A mathematical model is presented for the calculation of the concentrations or activities of complex compounds at thermodynamic equilibrium. Ten central atoms and ten ligands which form 400 complexes at the most can be included in the model. Complex stability constants, total concentrations of the central atoms and ligands, temperature and pH-value constitute input quantities. Activity and temperature dependence of the stability constants are covered by respective subprograms. The model is tested by the migration rate of iron(II) within a sand-filled column with a cation-exchange capacity of 1 mval/100 g solid matter: If there is an excess of sulfate, the iron(II)-breakthrough will be considerably earlier, the same holding for the EDTA-complex, whereas by means of EDTA the iron(II) bonded to the soil by ion exchange can be redissolved. In the batch experiment also the rate of oxidation of iron(II) is dependent on the degree of complexing. The model can be extended for dissolving, precipitation and redox processes. (Author's abstract)
W86-00394

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS, PART I: COLLECTION EFFICIENCY OF UNCHARGED SNOW CRYSTALS FOR MICRON AND SUBMICRON PARTICLES,
Hokkaido Univ., Sapporo (Japan). Div. of Environmental Structure.
For primary bibliographic entry see Field 2B.
W86-00426

RETENTION AND RELEASE OF SELECTED MAJOR AND MINOR METALS BY THE ALTAMAHA RIVER MARSH ECOSYSTEM,
Savannah State Coll., GA. School of Science and Technology.
For primary bibliographic entry see Field 2L.
W86-00431

SEDIMENT ACID NEUTRALIZATION IN SOFTWATER LAKES,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 2H.
W86-00432

FLUCTUATION IN NUTRIENTS DURING TIDAL CYCLES AT OYSTER BEDS IN THE RIVER PENZE (NORTH FINISTERE) (FLUCTUATIONS DES NUTRIMENTS AU COURS DE LA MAREE SUR LES PARCS OSTREICOLES DE LA RIVIERE PENZE (NORD-FINISTERE)),
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
For primary bibliographic entry see Field 2L.
W86-00447

STATE OF METAL IONS IN NATURAL WATERS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
P. N. Linnik, and B. I. Nabivanets.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 335-361, 1984. 1 Fig, 3 Tab, 178 Ref.

Descriptors: *Natural waters, *Metals, *Ions, Chemical complexes, Heavy metals, Organic compounds, Water analysis, Ligands.

Data obtained from the literature and original research showing the concentrations of microelements in oceans, seas, lakes and reservoirs, and rivers; the ratios of complexed and uncomplexed forms of macro- and microelements in some lake waters; and the molecular mass of metal complexing compounds are presented, and metal complexation is reviewed. A research method for determining the state of metal ions in natural waters also is described. Microelements discussed include Fe, Al, Mn, Zn, Cu, Ni, Co, V, Mo, Ti, Rb, Ag, Cr, and Pb. Ratios of aquacomplexes and inorganic compounds to complexes with macromolecular ligands in lake water are given for Mg, Ca, Ba, Fe, Al, Mn, Cu, Zn, Cd, Pb, Ni, Cr, Sc, La, Ce, and Th. Complexing substances involved with Fe include humic compounds, fulvic acids, and dissolved organic compounds, with molecular masses ranging from less than 5,000 to 20,000. Cd, Cu, and Pb have been found complexed with dissolved organic compounds with weights from less than 1,400 to over 45,000; Cu also complexes with fulvic acids and protein-like compounds. Mn is found complexed with dissolved organic compounds of weights from 500-150,000. Hg is found in complexes with dissolved organic compounds of 500-300,000 molecular weight. The most general characteristics of the state of metal ions in natural waters are metal distribution among suspended, colloid-dispersed and truly dissolved forms; concentration of free (noncomplexed) metal ions; charge sign; molecular (ionic) mass of complex or polynuclear compounds; kinetics of the complexing process; degree of strength of metal binding to the complex; and degree of metal oxidation. These characteristics of metal ions were employed to develop a flow chart for determination of the state of metal ions in natural waters. Electrophoresis, ion exchange, diffusion, and filtration methods are among the laboratory methods used in determination of the forms of metal ions. (Rochester-IVI)
W86-00537

RELATIONSHIP BETWEEN ORGANIC CARBON AND CHEMICAL OXYGEN DEMAND,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
L. Prochazkova, and P. Blazka.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 383-392, 1984. 2 Fig, 6 Tab, 23 Ref.

Descriptors: *Organic carbon, *Chemical oxygen demand, *Fate of pollutants, Reservoirs, Ponds, Brooks, Rivers, Sediments, Linear regression analysis.

Data on chemical oxygen demand (COD) give the amount of oxygen required for oxidation under fairly severe conditions. This corresponds to the concentration of organic compounds present if inorganic reducing substances are low and negligible. The chemical oxygen demand/organic carbon (COD/OC) ratio was determined for samples from two ponds, one brook, three rivers and four reservoirs. All samples were taken from sampling stations with a low organic load, (2.6-127 mg/l COD and 0.9-38 mg/l OC). In the course of self-purification, the OC concentration in rivers and reservoirs decreases to 8 mg/l, whereas ponds reached minimum values of the same size. The quotient COD/OC varies as the mean value for the individual waters between 2.55 in reservoirs and 3.92 in ponds. The overall trend of the values in the sequence of pond-river-reservoir is decreasing. The variability of the COD/OC ratios both within and between the groups results in artificial intercepts in linear regressions of the two parameters. Quotients larger than four may be associated with sulfur-containing compounds possibly coming from the sediments. The COD/OC ratios may vary with the origin of the samples and the use of a unified ratio in calculations may cause errors which are not negligible. (Moore-IVI)
W86-00540

NITROGEN, PHOSPHORUS, AND ORGANIC CARBON CYCLING IN AN ARCTIC LAKE,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2H.
W86-00611

2L. Estuaries

EVALUATION OF MARSH/ESTUARINE WATER QUALITY AND ECOLOGICAL MODELS: AN INTERIM GUIDE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. W. Hall.
Miscellaneous paper EL-82-1, January 1982. Final Report. 24 p, 5 Tab, 91 Ref.

Descriptors: *Estuaries, *Marshes, *Model studies, *Water quality, Coastal marshes, Mathematical models, Wetlands.

This report presents water quality and ecological problems in coastal marshes and estuaries, suggests applicable modeling approaches to problem solution, and provides the basis for the modeling recommendations through a brief summary of water quality and ecological modeling in the marsh/estuarine environment. (Author)
W86-00314

COLUMBIA RIVER ESTUARY HYBRID MODEL STUDIES: REPORT 4, ENTRANCE CHANNEL TESTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
W. H. McAnally, N. J. Brogdon, and J. P. Stewart.
Technical Report HL-83-16, September 1983. 147 p, 5 Fig, 20 Tab, 101 Plates, 9 Ref.

Descriptors: *Estuaries, *Channels, *Navigation, *Shoals, *Model studies, *Hydraulic models, *Dredging, Columbia River estuary, Channel improvement.

A hybrid modeling approach using a fixed-bed physical model, numerical models, and analytical techniques was used to study navigation channel shoaling at the mouth of the Columbia River. Sixteen plans for reducing channel maintenance dredging at the existing 48-ft depth and at 55- and 60-ft depths were tested. Effects of the plans on tides and currents were found to be subtle. Nondeepening plans had minor effects on salinity intrusion while channel deepening increased salinities by 1 to 6 parts per thousand up to about mile 18. Only one stuctural plan reduced shoaling below base conditions for the 48-ft channel. Channel deepening increased shoaling considerably.
W86-00357

LONG ISLAND SOUND THAMESVILLE TIDAL-FLOOD MANAGEMENT WATER RESOURCES STUDY, NORWICH, CONNECTICUT.
Corps of Engineers, Waltham, MA. New England Div.
For primary bibliographic entry see Field 4D.
W86-00372

BEACH CHANGES AT NAUSET INLET, CAPE COD, MASSACHUSETTS: 1670-1981,
Woods Hole Oceanographic Institution, MA.
P. E. Speer, D. G. Aubrey, and E. Ruder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-10117 0. Technical Report WHOI-82-40. August 1982. 92 p. 15 Fig, 2 Tab, 22 Ref, 4 Append. Contract/Grant No. NA 80-AA-D-00077(R/B21), DAAG29-81-K-0004.

Descriptors: *Beach erosion, *Beach profiles, Inlets, Tidal effects, Maps, History, Cape Cod, Massachusetts.

A historical study of barrier beach and inlet changes for the Nauset Inlet region, Cape Cod, Massachusetts, was performed to document patterns of beach and inlet change as a preliminary to designing and carrying out field studies of inlet sediment transport. One hundred twenty historical charts from 1670 and 125 sets of aerial photographs from 1938 formed the basis for this study. Specific aspects of barrier beach and inlet change addressed include onshore barrier beach movement, longshore tidal inlet migration, and longshore sand bypassing past the inlet. In an effort to correlate forcing events with barrier changes, an exhaustive study of the local storm climate was performed. Storm induced shifts in inlet position associated with superelevated water levels are rare but significant occurrences. These major inlet relocations have played an important role at Nauset Inlet by shifting the inlet position to the north. Steady northward migration characterized by flow around a bend during ebb tides has occurred since 1972 when a storm breach rapidly shifted the inlet location. The result is a steady northward migration. A third pattern of inlet migration is the growth of the downdrift spit by addition of sediment from ebb tide delta distal bars.
W86-00379

BIOMASS AND MINERAL COMPOSITION OF AQUATIC MACROPHYTES IN THE HYGAM WETLAND, KASHMIR WITH REFERENCE TO SUBSTRATE NUTRIENTS,
Kashmir Univ., Srinagar (India). Dept. of Botany.
S. Kaul.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 81-91, 1984. 5 Fig, 4 Tab, 29 Ref.

Descriptors: *Wetlands, *Hygam Wetland, *Jammu and Kashmir, *India, *Minerals, *Aquatic macrophytes, Seasonal variation, Macrophytes, Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Dissolved oxygen.

The Hygam wetland is situated at an altitude of 1565 m above sea level and lies in the Kashmir Valley. It is a bird sanctuary with an area of 56 hectares. The wetland is covered by a luxuriant growth of macrophytes dominated by the associations of Phragmites communis, Sparganium erectum, Scirpus lacustris, and Typha angustata. Sediments are fine greyish, the silt and clay forming the major constituents. The geological substratum is chiefly calcite. The studies were carried out at eight sites from March 1975 to February 1976. Among six mineral constituents estimated in the above ground and below ground tissues, calcium, nitrogen, and potassium were found in higher concentrations. The mineral constituents show clearly decreasing concentration during the season of vegetation. In a regression analysis the biomasses show significant multiple regressions to concentrations of chloride-ions, nitrogen and partly TPP and oxygen in the water and sediment. (Baker-IVI)
W86-00400

RETENTION AND RELEASE OF SELECTED MAJOR AND MINOR METALS BY THE ALTAMAHA RIVER MARSH ECOSYSTEM,
Savannah State Coll., GA. School of Science and Technology.
M. P. Menon, and G. S. Ghuman.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 195-206, June, 1985. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Marshes, *Ecosystems, *Metals, *Altamaha River, *Georgia, Magnesium, Potassium, Zinc, Manganese, Plants, Nutrients, Heavy metals, Uptake.

The periodic uptake of two nutrients (major metals, K and Mg) and two heavy metals (minor metals, Zn and Mn) by two different plant species, Spartina alterniflora and S. cynosuroides that grow on different sites in the marsh islands along the terminal course of Altamaha river (Georgia) was investigated. The metal content was analyzed of the dead species and of the soil and the retention or release of the major and minor metals of each of the two ecosystems were evaluated. No significant correlation was noted between plant uptake of Mn, Zn, K, and Mg and the DTPA or ammonium acetate extractable metals of the same kind in the soil. Although there are seasonal variations in the uptake of metals by both plant communities (S. alterniflora and S. cynosuroides) the maximum occurs at different times. In general, the metal content of the dead material shows a maximum in December. The periodic retention or release behavior of the four metals for the system as a whole is also different for different metals. It appears that the salt marsh along the Altamaha river where S. cynosuroides grows releases larger amounts of Mn than the ecosystem that is populated with S. alterniflora. Zinc is retained by both systems while each of them is replenished with Mg and K annually. (Baker-IVI)
W86-00431

TURBIDITY ENHANCES FEEDING ABILITIES OF LARVAL PACIFIC HERRING, CLUPEA HARENGUS PALLASI,
Oregon State Univ., Newport. Marine Science Center.
G. W. Boehlert, and J. B. Morgan.
Hydrobiologia, Vol. 123, No. 2, p 161-170, 1985. 6 Fig, 2 Tab, 42 Ref. OWRT grant 14-34-0001-1461.

Descriptors: *Turbidity, *Herring, *Larvae, *Feeding, *Estuarine environment, Habitats, Suspended sediments, Fish behavior, Sediments, Volcanic ash, Immature growth stages.

The larvae of many species of fishes inhabit estuaries when turbidity is high, and some species prefer turbid conditions, at least as juveniles. Larval Pacific herring are able to feed at a greater rate under moderate suspensions of fine-grained sediment and volcanic ash than under clear-water control conditions. This ability decreases with increasing suspension level. Two mechanisms are suggested to account for the enhancement of feeding over controls. First, it is suggested that in the small visual field of the larvae, contrast is enhanced by the background provided by the sediment particles. Secondly, the particles scatter light in all directions, possibly resulting in greater illumination of the food particles, which in turn can decrease the transparency of the food particles. Feeding abilities of the larval herring are thus adapted to residence in the turbid estuarine environments occupied during the larval stage. (Baker-IVI)
W86-00444

FLUCTUATION IN NUTRIENTS DURING TIDAL CYCLES AT OYSTER BEDS IN THE RIVER PENZE (NORTH FINISTERE) (FLUCTUATIONS DES NUTRIMENTS AU COURS DE LA MAREE SUR LES PARCS OSTREICOLES DE LA RIVIERE PENZE (NORD-FINISTERE)),
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
G. Boucher, and R. Boucher-Rodoni.
Hydrobiologia, Vol. 123, No. 3, p 251-261, April, 1985. 5 Fig, 1 Tab, 35 Ref.

Descriptors: *Nutrients, *Tidal effects, *Oysters, *Penze, *France, *Estuarine environment, Amines, Multivariate analysis, Ammonia.

The importance of short-term fluctuations in nutrients and primary amines over oyster beds during spring and neap tidal cycles was analyzed. The range of the variations recorded over 24 h is of the same order of magnitude as that observed over an annual cycle. Multivariate analysis, taking into account all available parameters concerning the tidal cycles, showed a short-term evolution of primary amines and ammonia nitrogen, independent from that of other parameters. The latter fluctuate in synchronization with the down-and-up-stream flow of the river Penze. The mean ammonia nitrogen concentration is higher during spring tide than during neap tide, and ammonia is more concentrated at the bottom than in the surface water. This higher concentration of ammonia in bottom water is related neither to current speed, not to interstitial water dilution by sediment resuspension. Nutrient exchanges between the sediment and the water column did not seem to be an important source of ammonia, while ammonia excretion by oysters might be the main source of this nutrient at the bottom level, particularly during spring tide. (Author's abstract)
W86-00447

TIDICS - CONTROL OF TIDAL RESIDUAL CIRCULATION AND TIDAL EXCHANGE IN A CHANNEL-BASIN SYSTEM,
Kyoto Univ. (Japan). Dept. of Fisheries.
M. Kashiwai.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 1-10, February, 1985. 14 Fig, 5 Ref.

Descriptors: *Tidal currents, *Tidal exchange, *Channels, *Basins, Tidal jet, Hydraulic models, Model studies, Oscillations, Water currents, Vorticity, Bays, Tides.

A self-excited oscillation of tidal flow occurs in a tidal channel-basin system with a narrow and high speed inflowing tidal jet. The mechanism of this oscillation was examined through hydraulic experiments. Results show that the oscillation is caused by alternation in the strength of asymmetric residual circulation caused by a biased supply of vorticity by asymmetric tidal vortex pairs, and that the mechanism of alternation also depends on negative feed-back between the residual circulation and the vorticity supply. The unstable state of the flow suggested the possibility of controlling the tidal current and tidal exchange in the channel-basin system and this was confirmed experimentally. Under fixed tidal conditions and with fixed basin dimensions, the tidal residual circulation was controlled to form two strong clockwise and anticlockwise circulations or a single circulation by changing the shape of the bay entrance. (Author's abstract)
W86-00448

HYDRAULIC EXPERIMENT ON TIDAL EXCHANGE,
Kyoto Univ. (Japan). Dept. of Fisheries.
M. Kashiwai.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 11-24, February, 1985. 12 Fig, 6 Tab, 13 Ref.

Descriptors: *Tidal exchange, *Tidal currents, Hydraulic models, Water currents, Bays, Channels, Mixing, Model studies.

Tidal exchange through a narrow entrance channel was studied experimentally with the use of a simplified hydraulic model. The inflowing water mass, visualized with dye solution, exhibits the shape of a starting plume with a starting vortex pair at its head. Because of their periodical formation by the tide, these are called the 'tidal plume' and 'tidal vortex pair'. The axis of the tidal plume deflects and undulates with a period 2 to 9 times that of the tide. Together with this undulation, the vortex pair becomes asymmetric. A circulating flow is formed in the bay which affects the shape of the inflowing

and outflowing water masses. A part of the inflowing water mass flows out during the subsequent ebb, and this outflowing portion can be divided into two parts. One is the water remaining in the entrance channel at high water which flows out during the first half of the subsequent ebb and the other is the water flowing round the bay in the circulating flow during flood that flows out during the latter half of the subsequent ebb. Both contribute to the exchange ratio, but one can estimate an upper limit for the exchange ratio by neglecting the latter outflow. This neglected portion is considered in the concept of the age composition of outflowing water. The age composition of the bay water shows the existence of intermittent effluence superposed on a trend in the age composition that is similar to that of the well-mixed case. From the analysis of a model consisting of a number of mixing tanks connected in series with a recycle flow, it is concluded that this intermittent effluence occurs in the case of weak mixing due to the effect of circulating flow in the bay but is negligible in the case of strong mixing. (Author's abstract)
W86-00449

OBSERVATIONS OF INTERNAL TIDES IN UCHIURA BAY,
Tokyo Univ. of Fisheries (Japan).
M. Matsuyama, and T. Teramoto.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 1, p 39-48, February, 1985. 9 Fig, 8 Tab, 9 Ref.

Descriptors: *Tidal currents, *Internal tides, *Uchiura Bay, *Japan, Thermocline, Thermal stratification, Oscillation, Standing waves.

Remarkable tidal currents associated with temperature fluctuations in the subsurface layer has been observed in Uchiura Bay. In order to study the characteristics of these tidal currents, current measurements were carried out in November 1972 and October 1974. It was confirmed from the first set of observations in 1972 that the tidal currents above and below the seasonal thermocline oscillate out of phase with each other and the tidal currents are associated with internal tides. In the second set of observations in 1974 not only current measurements but also serial BT loweringe were made. The phase of the thermocline displacements lagged behind the tidal currents by 81 degrees for the semidiurnal constituent and by 83 degrees for the diurnal constituent, and it is thus concluded that the internal tides in Uchiura Bay behave as standing waves. (Author's abstract)
W86-00450

IN SITU MEASUREMENT OF OXYGEN CONSUMPTION RATE IN THE BOTTOM LAYER IN MIKAWA BAY,
Institute of Physical and Chemical Research, Saitama (Japan).
S. Unoki, Y. Saijo, and S. Tawara.
Journal of the Oceanographical Society of Japan, Vol. 41, p 59-62, 1985. 3 Fig, 4 Ref.

Descriptors: *Mikawa Bay, *Japan, *Oxygen consumption, *Eutrophication, *Tidal waters, Salinity, Dissolved oxygen, Water temperature, Water currents, Wind.

Direct estimation of the oxygen consumption rate in the bottom layer of Mikawa Bay (Japan) where eutrophication is in progress was attempted using in situ continuous measurement of oxygen content and other oceanographic parameters. The ten parameters studied included water temperature, salinity, current velocity and direction, and dissolved oxygen. A change was noted in dissolved oxygen concentration from 21 to 25 July 1974. A gradual decrease in oxygen in the deeper layer was noted from 22 July to early morning of 25 July, with some fluctuations which can possibly be attributed to tidal motion. This gradual change was interrupted at 4 am on the 25th by a strong wind which arose on the afternoon of the 24th. The oxygen content in the deeper layer increased suddenly, and the difference in water temperature between the upper and lower layer diminished. An abrupt decrease in salinity in the lower layer at this time suggests mixing of the upper and lower waters. Data suggest that a water mass, in which the temperature and the salinity differ lateraly depending on the ratio of mixing, moves in and out with the tide. It is surmised that at the buoy location the bottom water was stagnant during this period even though it underwent tidal movement. (Baker-IVI)
W86-00451

HEAVY METAL CONTENT OF OYSTER, BLUE MUSSEL AND GROWING WATER IN HANSAN-GEOJE BAY (IN KOREAN),
Fisheries Research an Development Agency, Pusan (Republic of Korea).
For primary bibliographic entry see Field 5C.
W86-00454

MEIOFAUNA ASSOCIATED WITH MANGROVES IN THE HUNTER RIVER ESTUARY AND FULLERTON COVE, SOUTH-EASTERN AUSTRALIA,
Australian National Univ., Canberra. Dept. of Zoology.
M. Hodda, and W. L. Nicholas.
Australian Journal of Marine and Freshwater Research, Vol. 36, No. 1, p 41-50, 1985. 2 Fig, 5 Tab, 21 Ref.

Descriptors: *Invertebrates, *Mangroves, *Hunter River Estuary, *Fullerton Cove, *Australia, Estuarine environment, Water pollution effects, Salinity, Particle size, Elevation, Copepods, Nematodes, Oligochaetes.

The Hunter River estuary and adjacent Fullerton Cove (Australia) were chosen for this study, partly because of the extensive stands of a single species of mangrove, Avicennia marina, that occur there and partly because of the range of estuarine conditions present, some of which include industrial pollution. The meiofauna from 14 sampling sites around the Hunter River estuary is described, and the factors influencing total density and relative abundance of nematodes and copepods and some species distributions are discussed. Elevation above low tide mark influenced nematode density, and salinity influenced copepod density and relative abundance. Both nematodes and copepods were most dense near the mud surface, and algal food and the depth of the reducing layer appear to be partially responsible for major differences in the density of these two taxa at different sites. Pollution also influenced the total density of both nematodes and copepods and also the relative abundance of oligochaetes. There was a lack of any statistically significant relationship between the median grain size and either the relative abundance of nematides or copepods or the ratio of nematodes to copepods; pollution or substantial differences in trophic dynamics of the fauna may obscure the relationship. (Moore-IVI)
W86-00521

SEDIMENTATION OF PARTICULATE MATERIAL IN NORDASVANNET, A HYPERTROPHIC, LAND-LOCKED FJORD IN WESTERN NORWAY,
Bergen Univ. (Norway). Inst. of Marine Biology.
P. Wassmann.
Marine Ecology - Progress Series, Vol. 22, No. 3, p 259-271, March, 1985. 7 Fig, 2 Tab, 51 Ref.

Descriptors: *Fjord, *Sedimentation, *Nordasvannet, *Norway, Particulate matter, Wastewater pollution, Seasonal variation, Mineralization, Phosphorus, Chlorophyll a, Biomass, Phytoplankton.

Sedimentation of particulate material to the sea bottom (90 m) was measured in Nordasvannet, a land-locked, highly stratified, west-Norwegian fjord, receiving fresh water from a small glacier-free watershed and untreated domestic sewage from 30,000 persons equivalents. Five cylindrical sediment traps positioned 20, 40, 45, 50, and 65 m below the water surface were deployed from March 1982 to April 1983. Variability of seasonal sedimentation rates was small, especially at greater depths. Sedimentation rates of total particulate material and particulate organic carbon decreased from 594 and 83 at 20 m, to 389 and 58 g/sq m/yr, respectively, in deeper water. Possible reasons for decreasing sedimentation with increasing depth are mineralization in the water column and lack of resuspension in deeper water. However, sedimentation rates of particulate total phosphorus and chlorophyll a equivalents increased between 20 and 45 m depth. These conflicting results were interpreted as a possible consequence of specific lower catchment efficiencies of the uppermost traps and artificial mineralization inside the traps. No evidence was found for sedimentational responses on time variations of suspended biomass, yet larger parts of the biomass of the spring phytoplankton bloom settled to the seafloor of Nordasvannet. Besides fecal pellets few recognizable structures were found in the traps. The POC content of the deposited material was high compared to results given in literature and comprised 10 to 21%. It is hypothesized that a large and continuous allochthonous supply of nutrients to Nordasvannet equalizes both primary production and its sedimentation. (Author's abstract)
W86-00527

MINERAL SALTS AND TIDAL CYCLES IN AN ESTUARY IN NORTH BRITTANY (DOURDUFF, FRANCE) (SELS MINERAUX ET CYCLES DE MAREES DANS UN ESTUAIRE DE BRETAGNE NORD (DOURDUFF, FRANCE)),
Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
C. Riaux-Gobin.
Hydrobiologia, Vol. 124, No. 1, p 35-44, May, 1985. 6 Fig, 2 Tab, 26 Ref.

Descriptors: *Nutrients, *Tides, *Estuaries, *Dourduff, *France, Ammonium, Nitrates, Nitrites, Silicon dioxide, Phosphates, River flow, Seston, Resuspension, Seasonal variation.

Short-term variations in nutrient concentrations of water-masses have been studied in a Brittany estuary over several tidal cycles, during winter and summer. NH4(+), NO2(-), NO3(-), SiO2 and PO4(3-) have been measured at a fixed station. The Dourduff estuary (France) is characterized by a very low river discharge (80 l/s during the minimum water runoff and 1 000 l/s during the maximum) and an important tidal range (9 m at spring tides). SiO2 and NO3(-) concentrations are directly related to freshwater flow whereas PO4(3-) is partially adsorbed by seston in the turbid ebb waters. NH4(+) concentration seems to be, in part, dependent upon sediment resuspension: late ebb and onset of flood periods liberate NH4(+) into the overlying water column. Nutrient concentrations are also related to seasons. Nutrient fluxes are insignificant or negative during summer periods, so the estuary imports nutrients for its own regulation whereas during winter periods is exports NO3(-) and SiO2 (ca 50 kg NO3(-) and ca 200 g SiO2 during a single spring tide). The NO3:PO4 ratio is always above 15:1 and can reach 300:1; moreover this ratio fluctuates during the tidal cycle. This imbalances originates in terrestrial discharges of nitrogen compounds. (Author's abstract)
W86-00530

RELATIONSHIP OF CELLULAR PHOSPHORUS IN THE CYANOBACTERIUM NODULARIA TO PHOSPHORUS AVAILABILITY IN THE PEEL-HARVEY ESTUARINE SYSTEM,
Western Australia Univ., Nederlands. Inst. of Agriculture.
K. S. Hamel, and A. L. Huber.
Hydrobiologia, Vol. 124, No. 1, p 57-63, May, 1985. 4 Fig, 2 Tab, 22 Ref.

Descriptors: *Estuarine environment, *Phosphorus, *Nodularia, *Peel-Harvey Estuarine System, *Western Australia, Cyanophyta, Eutrophication, Water pollution sources, Limiting nutrients, Cycling nutrients.

A laboratory-determined 'critical concentration' of phosphorus in the cyanobacterium Nodularia spumigena was used to assess the phosphorus sufficiency of field populations in the Peel-Harvey Estuarine System, Western Australia. Nutrient addition bioassays indicated that phosphorus was the

limiting nutrient. Since river flow, and thus phosphorus input, to the estuary ceases 1-2 months before the onset of Nodularia blooms, the phosphorus contained in these blooms was derived from sediment release and nutrient recycling. A progressive increase in the mean cellular phosphorus concentration of Nodularia from 1981 to 1983 indicated that sediments were releasing a greater amount of phosphorus each year. Although evidence suggests that the biomass of recent Nodularia blooms is now limited by physical factors, the additional phosphorus contained in each bloom will increase the supply of phosphorus to other organisms. Cellular phosphorus concentrations in Nodularia appeared to be correlated with river phosphorus loadings in the Peel Inlet but not in the Harvey Estuary. (Author's abstract)
W86-00531

STATISTICAL MODELING OF HISTORIC SHORE EROSION RATES ON THE CHESAPEAKE BAY IN MARYLAND,
Naval Academy, Annapolis, MD. Dept. of Mathematics.
For primary bibliographic entry see Field 2J.
W86-00556

EVALUATION OF THE RELEVANCE OF SOME ENVIRONMENTAL FACTORS TO THE ESTIMATION OF MIGRATORY TIMING AND YIELD FOR THE BROWN SHRIMP OF PAMLICO SOUND, NORTH CAROLINA,
Old Dominion Univ., Norfolk, VA. Dept. of Oceanography.
M. A. Matylewich, and P. R. Mundy.
North American Journal of Fisheries Management, Vol. 5, No. 2A, p 197-209, Spring, 1985. 4 Fig, 9 Tab, 30 Ref.

Descriptors: *Shrimp, *Migration, *Pamlico Sound, *North Carolina, *Mathematical models, Water temperature, Salinity, Air temperature, Precipitation, River discharge, Shellfish, Prediction,.

A linearized logistic model and a multiple linear model were used to relate environmental factors (week number, water temperature, salinity, air temperature, precipitation, net heating degree days, river discharge) to the time distribution of the cumulative proportion of catch and catch per unit effort of the brown shrimp (Penaeus aztecus), respectively. Multiple regression analysis yielded equations containing the week number, the water temperature, and an interaction term as the independent variables. Predictions of total annual yield and total annual catch per unit effort are made using the migratory time density approach. The time factor, represented by weeks numbered throughout the year, contributes the most in explaining the variation in the migratory timing. Models for predicting migratory behavior and yield in the brown shrimp should consider water temperature to be a significant factor. Although the models are not statistically precise, the empirical predictions are an improvement over existing estimators. (Author's abstract)
W86-00589

NUMERICAL MODEL FOR TIDAL CURRENT IN THE CHANGJIANG RIVER ESTUARY,
Nanjing Hydraulic Research Inst. (China).
S. Zhao.
Oceanologia et Limnologia Sinica, Vol. 16, No. 1, p 18-27, 1985. 10 Fig, 4 Ref.

Descriptors: *Mathematical models, *Tidal currents, *Changjiang River Estuary, Estuaries, Eddy viscosity, Boundary conditions, Costs.

This paper presents a generalized finite difference scheme for the solution of the two-dimensional current equations expressed as being integrated over the vertical. In this paper the Changjiang River Estuary is simulated in order to investigate the effectiveness of the method on tidal current. The computational results agree well with the tidal current field survey data. Plane domain is supposed to consist of triangular elements of weakly acute type. Partial derivatives of order 1 and 2 are defined at nodal points. In the basic equations of tidal current horizontal eddy viscosity term is also considered. This method has a great advantage of having the flexibility to express the configuration. That is, the boundary configuration of the model is more accurate, and an interested area of the computation by the method can be divided into any small elements arbitarily. Moreover, the computational cost of this method is cheaper. (Author's abstract)
W86-00601

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

COMBINED HYDROMETEOR DISTRIBUTIONS FROM THREE PMS PROBES,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
G. L. Gordon.
IN: Cloud Physics in the SCPP: Interim Progress Report, 1983-84, December 29, 1984. p 53-85, 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Measuring instruments, *Cloud physics, *Precipitation, *Lasers, Hydrometeor distribution, Sierra Nevadas, Meteorological data collections, Ice.

The combined hydrometeor distributions observed by three optical array probes are described. The total hydrometeor distribution can be partitioned into several regions of exponential distributions, each having its own slope and intercept. The different exponential regions are probably the result of different growth characteristics occurring at those particular sizes. Use of a single probe is not sufficient for determining total hydrometeor distributions. The overlapping sizes between the probes can be used to eliminate the size bins that have measurement problems, thus producing a spectrum with more valid numbers. In regions of secondary ice crystal production and when there are sufficient large particles, the hydrometeor spectrum can be represented by a single parameter distribution.
W86-00308

GROSSVERSUCH IV: 'EXTENDED AREA' EFFECTS ON RAINFALL,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
H. H. Schiesser.
Journal of Climate and Applied Meteorology, Vol. 24, No. 3, p 236-252, March, 1985. 15 Fig, 5 Tab, 14 Ref.

Descriptors: *Cloud seeding, *Rainfall, *Hail suppression, Switzerland, Weather modification, Statistical analysis.

Grossversuch IV, the Swiss randomized hail suppression experiment, was designed to test the hypothesis that seeding hail clouds, according to the beneficial competition concept, would decrease the hail kinetic energy. Two different networks of raingages were used to analyze 37 seed and 50 no-seed days for possible seeding effects on rainfall during the hail suppression experiment in Switzerland. 'Moving grid' analyses within a range of 100 km of the seeding center showed no statistical evidence of a seeding effect for 24 h-values. For the experimental unit (9 h), and area 'upwind' (with respect to the mean wind direction) of the target showed a statistically significant increase in rainfall of 118% on seed days, although no 'upwind' effect should be expected. Four heavier rainfalls dominate the seed ensemble and are responsible for that effect. But on those days the environmental wind directions and the movements of the single cells (seeded) point in the opposite direction of the 'upwind' area. Despite randomization, the effect must be mainly due to natural variability. Thus other effects in the target or 'downwind' must likewise be regarded as random. There may be a small seeding effect, especially in a shorter time interval. (Moore-IVI)
W86-00424

3F. Conservation In Agriculture

ROW SPACING, PLANT POPULATION, AND WATER MANAGEMENT EFFECTS ON CORN IN THE ATLANTIC COASTAL PLAIN,
Agricultural Research Service, Florence, SC.
D. L. Karlen, and C. R. Camp.
Agronomy Journal, Vol. 77, No. 3, p 393-398, May-June, 1985. 6 Tab, 35 Ref.

Descriptors: *Corn, *Row spacing, *Plant population, *Irrigation scheduling, Water management, Water stress, Fertilizers, Soil water, Crop yield, Computers, Soil water potential.

Lack of water because of erratic rainfall frequently limits corn (Zea mays L.) production of Typic Paleudults in the Atlantic Coastal Plain. Traditionally, wide (96 cm) row spacing and low plant population have been used to prevent water stress, but recently landowners have begun to invest in irrigation systems. Changes in row spacing, plant population, or fertilization practices may be required to achieve maximum water- and nutrient-use efficiency with those systems. Plant population treatments averaging 7.0 and 10.1 plants/sq m in single and twin rows were investigated on a Norfolk (fine-loamy, siliceous, thermic Typic Paleudult) loamy sand during 1980, 1981, and 1982. Three water management (nonirrigated, irrigated using tensiometers (TENS) to measure soil-water potential for scheduling, and irrigated using a computer-based water balance (CBWB) for scheduling), and two fertilization programs were also evaluated in a four-factor split-plot design. Water management and plant population interacted significantly. Planting in twin rows increased grain yield an average of 0.64 Mg/ha (10 bu/A), but planting more than 7.1 plants/sq m significantly increased grain yield only in 1980. Irrigation increased grain yield 150, 161, and 8% in 1980, 1981, and 1982, respectively, as a result of increased kernal weight and number of kernals per ear. Increasing total N, P, and K application beyond 200, 30, and 167 kg/ha, respectively, did not significantly influence grain yield or yield components. Yield advantages of narrow rows can be obtained on Coastal Plain soil which require subsoiling by using a twin-row planting configuration. Irrigation can be scheduled using either tensiometers (soil-water potential) or a computerized water balance without significantly changing corn grain yield, nutrient accumulation, or yield components. (Author's abstract)
W86-00460

PHYSIOLOGICAL RESPONSE OF MEADOWFOAM TO CROP WATER DEFICITS,
Colorado State Univ., Grand Junction. Fruita Research Center.
C. H. Pearson, and G. D. Jolliff.
Agronomy Journal, Vol. 77, No. 3, p 422-426, May-June, 1985. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Meadowfoam, *Oilseed crops, *Water deficit, Water stress, Irrigation effects, Transpiration, Canopy temperature, Plant water potential, Osmotic potential, Turgor, Stomatal resistance.

The new oilseed crop, meadowfoam (Limnanthes alba), is adapted to wet meadows in its native habitat. The plant has been domesticated and commericalized. Plant water stress during seed development may be a cause of seed yield variation in cultivated fields. A field study was conducted to characterize meadowfoam response to water stress. Treatments included: no irrigation (control); early irrigation, during May (EI); and continued irrigation, from the 1st week of May until crop maturity (CI). Treatments were applied in a randomized complete block experimental design in 1981 and 1982. Plant water potential, turgor potential, osmotic potential, stomatal resistance, transpiration, and canopy temperature were measured at 0600, 0900, 1200, 1500, and 1800 h on several days during flowering and seed development. Generally, crop water deficits were greatest and transpiration was highest at 1500 h, and stomatal resistance

was highest in 1800 h. Meadowfoam maintained an unusually high water potential which did not drop below - 0.8 MPa. The amount of precipitation during flowering in 1982 was the lowest in 16 years. At mid-flowering after 1200 h the control plants had higher crop water deficits, higher stomatal resistance, lower transpiration, and slightly higher canopy temperature than the irrigated plants. The responses became progressively greater by late flowering and early seed fill. Crop water stress in the EI treatment was slight at mid-and late flowering, but because greater at early seed fill. Adaptation of meadowfoam to crop water stress by lowering osmotic potential was minimal. Canopy temperatures of the EI treatment at early seed fill averaged 0.8 C higher than the CI treatment. Meadowfoam requires a high water potential for growth and development, and its tolerance to crop water deficits is low. Stomata of meadowfoam close at relatively high plant water potentials. (Moore-IVI)
W86-00461

SUBIRRIGATION SYSTEM CONTROL FOR WATER USE EFFICIENCY,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
M. C. Smith, R. W. Skaggs, and J. E. Parsons.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 489-496, March/April, 1985. 13 Fig, 4 Tab, 12 Ref.

Descriptors: *Irrigation, *Water requirements, Irrigation requirements, *Water conservation, Subsurface irrigation, Simulation, Water table, Mathematical equations, Boussinesq equation.

An evaluation was made of water requirements of subirrigation under three methods of system control through both a field experiment and the use of computer simulation analysis. Field experiment results indicate that irrigation water requirements can be reduced by controlling the system such that the midpoint water table depth is allowed to fluctuate within certain limits. The simulation model was based on numerical solutions to the Boussinesq equation and was developed to allow comparison to be made between the control methods using historical weather records. Several simulations were conducted for each control method to optimize the set points for starting and stopping subirrigation for the given method. Using the optimum set points, the simulations pedicted a decreased irrigation requirement when the midpoint water table depth was allowed to fluctuate. The irrigation requirement was decreased by an average of 6.7% over constant water level control for five years of simulations. Much larger differences could have occurred had the set points not been optimized. There is potentially more difference in irrigation water requirements for different set points within a given control method than between two different control methods. There is a good potential for reducing irrigation requirements of subirrigation by using a simple control system employing a float switch triggered byth field water level. A slight modification in the way in which subirrigation systems are currently controlled can result in decreased water usage. (Baker-IVI)
W86-00473

THREE-DIMENSIONAL INFILTRATION AND TRICKLE IRRIGATION,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
B. Clothier, D. Scotter, and E. Harper.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 497-501, March/April, 1985. 5 Fig, 12 Ref.

Descriptors: *Soil water, *Trickle irrigation, *Infiltration, Flow, Permeability, Soil properties, Irrigation pattern.

The movement of water into the soil under a trickle emitter occurs in response to equi-dimensional capillary attraction and downward movement as a result of gravity. Soil texture, or more specifically soil pore geometry, determines the relative importance of gravity and capillary forces. The distribution of irrigation water from a drip emitter is dominated by the physical properties of the soil. In some cases the hydraulic properties of soil can be so variable in time and space as to negate the utility of detailed theoretical analyses. Efficient operation of trickle irrigation relies on the ability of the soil to transport the water away from the dripper into the root zone. Soil cracks, biopores and other preferential water flow pathways can act to subvert the uniform distribution of water. Economic returns from horticulture are often sufficient to allow for more elegant engineering design to eliminate the reliance on the soil as a distribution medium. Microjets, minisprinklers and sprinklers are options on such soils. These devices, in contrast to drippers, spread the water out over the soil surface. Minisprinklers can apply water at such a rate (flux density) as to prevent the formation of a surface free water pond. This irrigation water will then infiltrate the soil via smaller pores giving a more uniform wetting patern. The large pores which can only be accessed by free water, remain air-filled. Therefore the wetting of any portion of the root zone is a simple matter of minisprinkler engineering design, divorced from the confounding influence of the soil. (Baker-IVI)
W86-00474

FURROW COMPACTION FOR CONTROLLING EXCESSIVE IRRIGATION WATER INTAKE,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
J. T. Musick, F. B. Pringle, and P. N. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 502-506, March/April, 1985. 3 Fig, 4 Tab, 18 Ref.

Descriptors: *Irrigation practices, *Soil compaction, *Furrow compaction, Soil properties, Compaction, Irrigation, Soil water, Corn.

The results of testing the irrigation of SOFT and HARD furrow treatments for corn production are compared with a conventional control treatment of every-furrow (EF) irrigation. The EF treatment had alternating pairs of HARD and SOFT furrows. Soil bulk densities were evaluated below the soil surface in irrigated furrows. Also evaluated were irrigation water application, intake, surface runoff, soil water storage, estimated profile drainage, evapotranspiration, and corn yields. The field study was conducted on Olton clay loam which is a fine, mixed thermic family of Aridic Paleustolls. Wide spacing of furrows had very little effect, while wheel compaction reduced the average water intake during seasonal irrigation from 123 to 82 mm and estimated profile drainage losses from 29.4 to 9.1% of water applied. Tractor-wheel compaction from multiple field operations increased average dry soil bulk densities from 1.26 to 1.62 Mg/cubic m. Irrigated furrows were compacted as a separate tractor pass prior to the preplant irrigation, and effects remained throughout the growing season. The reduced water intake with furrow compaction did not affect corn grain yields. Alternating compacted and noncompacted furrows permits flexibility in irrigating for a range in water intake, depending on water use rates and profile soil water depletion. Irrigation of compacted furrows permits the use of a fixed pumping rate to irrigate a larger area by reducing profile drainage and increasing field application efficiency. (Baker-IVI)
W86-00475

BANANA YIELD AS AFFECTED BY DEFICIT IRRIGATION AND PATTERN OF LATERAL LAYOUTS,
Hawaii Univ. at Manoa, Honolulu. Dept. of Agricultural Engineering.
S. C. H. Young, T. W. Sammis, and I.-P. Wu.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 507-510 and 516, March/April, 1985. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Bananas, *Crop yields, *Drip irrigation, Deficit irrigation, Soil water, Evapotranspiration, Clay, Soil properties.

The water requirement of the banana plant for optimum growth and fruit production was determined and the effect of evapotranspiration and yield of deficit irrigation were also considered. The response of the banana plant to different wetting patterns formed by placing drip irrigation laterals at selected locations away from the mat was also investigated. Yield and evapotranspiration increased, as described by a linear relationship, up to the maximum application rate of 1.8 x pan plus effective rainfall (annual effective rainfall is 649 mm). The evapotranspiration associated with the maximum treatment was 2613 mm/year resulting in a yield of 126 t/ha averaged over two years which was considerably higher than the maximum reported yields in the literature of 50 to 60 t/da. Daily application of irrigation water using a drip irrigation system which maintains the soil moisture in a portion of the root zone near field capacity can double banana yields. The location of the drip system in relationship to the banana mat was statistically not significant. (Baker-IVI)
W86-00476

DROPLET SIZE DISTRIBUTION AND WATER APPLICATION WITH LOW-PRESSURE SPRINKLERS,
Wuhan Inst. of Hydraulic and Electric Power Engineering (China).
D. Chen, and W. W. Wallender.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 511-516, March/April, 1985. 9 Fig, 2 Tab, 14 Ref.

Descriptors: *Irrigation practices, *Water distribution, *Sprinkler irrigation, Nozzles, Drop size, Cost analysis, Spacing.

The interpretation of droplet size distribution and water distribution were enhanced over a range of operating pressures for noncircular nozzles. Droplet sizes and water application uniformity for square, double rectangular, and triangular nozzles were compared with the performance of circular nozzles of similar discharge characteristics. Generally, volume weighted mean droplet sizes were larger for noncircular nozzles at a given distance from the sprinkler but circular nozzles produced the largest average droplet size at the outer perimeter of their pattern. This was possible because the circular nozzles projected the water farther than their noncircular comparison nozzles. The soil damage hazard due to large droplets was further compounded by the high water application rate, near the perimeter (doughnut pattern), for circular nozzles operated at low pressures. Square and triangular nozzles produced doughnut shaped patterns only at the lowest pressure tested, 138kPa (20 psi). Cost analysis gave the cost-pressure relation needed as input to the sprinkler selection and spacing decision process. Costs for the noncircular and circular nozzle cases were comparable. Minimum cost sprinkler spacing along the lateral was nearly equal to spacing along the mainline for low-pressure nozzles while for circular nozzles, lateral spacing was a third to a half of mainline spacing. Mainline spacing was less for low-pressure sprinklers, therefore if a retrofit is proposed, closer spacing of lateral lines along the mainline is advised. (Baker-IVI)
W86-00477

INFILTRATION UNDER SURGE IRRIGATION,
Everglades Research and Education Center, Bella Glade.
F. T. Izuno, T. H. Podmore, and H. R. Duke.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 517-521, March/April, 1985. 5 Fig, 3 Tab, 11 Ref.

Descriptors: *Surge irrigation, *Infiltration, Soil water, Infiltrometers, Irrigation practices, Irrigation, Furrow irrigation, Wetting.

Surge irrigation advance studies were conducted in the field to illustrate the relationships between the surge infiltration phenomenon and the corresponding accelerated surge advance rates. Blocked furrow infiltrometer studies in the field were conducted on both surge and continuously irrigated furrows to quantify the reduction in infiltration

rates caused by surged applications. The surge irrigation infiltration phenomenon and its ability to enable the surge benefits to exist was explored. Although surge and continuous infiltration rates are numerically equivalent, a step drop from the high time dependent infiltration rate to the basic rate after one complete surge cycle is the apparent cause of the accelerated advance rates observed under surge irrigation. The step drop in surge infiltration rates results in smaller volumes of applied water required for advance when surge irrigation is used compared to continuous applications. The reduced infiltration phenomenon under surge irrigation appears not to undergo further reduction with subsequent surges of an irrigation. The phenomenon does not appear to be cumulative with successive irrigations of a season. Because of the relationship between infiltration rates and advance, surge irrigation reduces differences in rate of advance between furrows with different levels of compaction. Surge irrigation also reduces advance rate differences caused by repeated irrigations of a furrow. It appears that seasonal and compaction infiltration effects on advance can be reduced by maintaining surge cycle on times below the time where continuous advance curves begin to reflect infiltration differences. Three distinct phases of infiltration occur under surged furrow irrigation. These phases are infiltration into initially dry soil, infiltration into previously wetted soil, and a transition infiltration regime caused by increased wetted perimeters occurring after the first wetting of a furrow section. (Baker-IVI)
W86-00478

UNI-PLOT FOR DRIP IRRIGATION LATERAL AND SUBMAIN DESIGN,
Hawaii Univ. at Manoa, Honolulu. Dept. of Agricultural Engineering.
I.-P. Wu.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 522-528, March/April, 1985. 11 Fig, 1 Tab, 12 Ref.

Descriptors: *Drip irrigation, *Design criteria, *Irrigation, Irrigation practices, Infiltration, Hydraulic design.

A uni-plot is presented for drip irrigation lateral and submain design which applies the polyplot concept by plotting the energy gradient line and slope dimensionlessly. The uni-plot concept provides a simple design procedure for lateral and submain design for either uniform or non-uniform slope situations. The pressure variation along a lateral line or a submain is determined by balancing the energy drop by friction and the energy gain (or loss) due to slopes. For the concept of Poly-plot the reference area can be made by using an allowable pressure variation and either the slope profile or the energy gradient line (EGL). The allowable pressure variation is defined as the difference between maximum pressure and minimum pressure in the line which is determined based on the operating pressure and a design criterion of pressure variation expressed as a percentage. The EGL for a single-size lateral or submain is a curve and the EGL for a multi-size lateral or submain can be approximated by a straight line. By applying the concept of poly-plot and plotting the length and energy terms dimensionlessly, two uniplots were developed for lateral (or submain) design for a single size or multiple sizes. The uni-plot can be used for both uniform and non-uniform slope situations and used for checking the acceptability of a design or to design a lateral (or submain) size based on a design criterion. (Baker-IVI)
W86-00479

FURROW FIRMING FOR CONTROL OF IRRIGATION ADVANCE RATES,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
K. J. Fornstrom, J. A. Michel, Jr., J. Borrelli, and G. D. Jackson.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 529-531 and 536, March/April, 1985. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Furrow irrigation, *Advance rate, *Furrow compaction, Crops, Compaction, Soil compaction, No-till, Tillage.

An attempt was made to design, build and evaluate a tool which would increase the advance rate of irrigation water in no-till and conventionally tilled furrows. The specific design objectives of the tool were that it should reshape and compact the furrow as well as clear previous crop residue from the no-till furrows. The unit constructed to reshape and compact the furrows consisted of a furrow forming tool and a firming unit for each furrow mounted on a 3 point hitch toolbar. The firming unit consisted of 35 cm diameter V-shaped wheels, hinge mounted with a frame such that suitcase tractor weights could be attached to each row unit. The unit was evaluated by comparing water advance distances in firmed and unfirmed irrigation furrows with the same irrigation flow rates. Tests indicated improved advance rates for both no-till and conventionally tilled plots. Twice the advance distance was obtained in no-till plots when the firming unit with 144 kg of additional weight was used and approximately 40% more in conventionally tilled plots. Water advance distance, in no-till furrows after firming, approached those of the conventionally tilled furrows before firming. Soil cone index values obtained from penetrometer tests indicate that some compaction was obtained to a depth of 10 cm with a weighted firming wheel. A consistent increase in cone index for corrugated and firmed treatments (without weights) was not obtained. Thus the firming device was successful in improving irrigation water advance rates and uniformity of advance. Probable benefits of increased advance rates include reduction in leaching of fertilizers and pesticides and possible reduced soil erosion since smaller furrow flow rates can be used. (Baker-IVI)
W86-00480

SURGE FLOW BORDER IRRIGATION USING AN AUTOMATIC DROP GATE,
Alexandria Univ. (Egypt). Dept. of Agricultural Engineering.
S. M. Ismail, G. L. Westesen, and W. E. Larsen.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 532-536, March/April, 1985. 7 Fig, 6 Ref.

Descriptors: *Border irrigation, *Surge flow, *Gates, Drop gates, Design criteria, Irrigation efficiency, Irrigation practices, Automation.

Surge flow with border irrigation varies from that done with furrows because the outflow rate varies. One device used to control water in this fashion is an automatic drop gate. The gate has several advantages. It opens and closes automatically. The gate can be designed to utilize any available head between the reservoir water surface and the land irrigated. The head ditch can be used as a reservoir. No electronic system or timer is needed to control the cycle. Minimal management is required. The gate is easily designed and economically fabricated. Field experiments were conducted to evaluate border irrigation systems using surge flow and the automatic drop gate and compare surge flow with conventional continuous flow. Surge flow border irrigation resulted in better irrigation efficiency than continuous flow. The automatic surge flow gate that was developed performed as designed and showed the potential for automatic control. The design procedure developed can be used for different flow rate and border sizes. (Baker-IVI)
W86-00481

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

USE OF VEGETATION IN DELINEATING WETLAND BORDERS IN UPPER MISSOURI RIVER BASIN; NORTH-CENTRAL UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W86-00359

SELF-CLEANING, NON-POWERED TRASH SCREENS FOR SMALL IRRIGATION FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. A. Bondurant, and W. D. Kemper.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 113-117, January/February, 1985. 9 Fig, 4 Ref.

Descriptors: *Irrigation canals, *Trash screens, *Maintenance, Weed control, Screens.

Material found in irrigation water which will plug a siphon tube or a gated pipe outlet is collectively called trash. Included are live and dead plant material, fish, snails, worms, insects, aquatic plants, moss, algae, and miscellaneous materials such as plastics and aluminum cans. Three different self-cleaning trash screen configurations are described: the horizontal rectangular screen; the circular, center fed turbulent fountain screen; and an in-stream, submerged screen. The mode of operation to remove trash, screen construction and field test results are presented. Flat trash screens consisting of a frame, a support screen, and a final screen have been found to satisfactorily remove trash and some weed seeds from irrigation flows. These screens are essentially self cleaning if designed correctly. At least 0.20 m (8 in.) of head is usually required for self cleaning operation of either the rectangular screens or the turbulent fountain, center-fed screen. More head is desirable to create adequate turbulence but turbulence can be created using vortex shedding techniques. Most types of trash which come through a turnout can be removed if adequate head is available. An in-stream type trash screen was designed which operated successfully in a stream containing large amounts of pondweed. (Baker-IVI)
W86-00490

EFFECTS OF ARTIFICAL DRAINAGE ON SOIL MINERAL NITROGEN DYNAMICS IN WINTER WHEAT ON THE SOUTHERN PIEDMONT,
Georgia Univ., Athens. Inst. of Ecology.
P. M. Groffman, J. E. Box, Jr., and R. L. Todd.
Communications in Soil Science and Plant Analysis, Vol. 15, No. 9, p 1051-1063, August, 1984. 6 Tab, 18 Ref.

Descriptors: *Drainage effects, *Soil chemistry, *Nitrogen, *Wheat, Subsurface drainage, Mineralization, Nitrification, Crop yield, Fertilizers.

Excess soil moisture is believed to cause reduced levels of soil mineral N and crop production in winter wheat on the Southern Piedmont. Artificial subsurface drainage was used to relieve excess soil moisture and soil mineral N levels, mineralization, nitrification, denitrification and a group of soil properties were analyzed in both drained and undrained treatments. Drainage increased rates of mineralization and nitrification and decreased rates of denitrification, leading to higher levels of soil mineral N in drained plots than in undrained plots. Wheat yields were not affected by drainage, probably because the rate of N applied in spring (80 kg-N/ha) was high enough to counteract the effects of decreased soil mineral N levels in undrained treatments. (Author's abstract)
W86-00513

4B. Groundwater Management

GROUNDWATER DEVELOPMENT, KHARGA OASES, WESTERN DESERT OF EGYPT: A LONG-TERM ENVIRONMENTAL CONCERN,
La Moreaux (P.E.) and Associates, Inc., Tuscaloosa, AL.
P. E. LaMoreaux, B. A. Memon, and H. Idris.
Environmental Geology and Water Science, Vol. 7, No. 3, p 129-149, 1985. 20 Fig, 3 Tab, 139 Ref.

Descriptors: *Groundwater management, *Water resources development, *Egypt, Groundwater po-

tential, Wells, Artesian wells, Deserts, Hydrogeology, Water quality.

The groundwater reserves in Kharga Oases have been studied for the long-term socioeconomic development in the area. The Nubian Sandstone, which consists of a thick sequence of coarse clastic sediments of sandstone, sandy clay interbedded with shale, and clay beds, forms a complex aquifer system. The Nubian Aquifer has been providing water to artesian wells and springs in the Kharga Oases for several thousand years. Groundwater in the Kharga Oases is withdrawn from springs and shallow and deep artesian wells. Nearly all the wells originally flowed, but with the exploitation of groundwater from deep wells for irrigation beginning about 1959, the natural flows declined as more and more closely spaced deep wells were drilled. By 1975 many deep wells had ceased to flow. The water demand in the area has been met by pumping both shallow and deep wells. The total annual extraction from deep wells has fluctuated over the year, however, the annual withdrawal from deep wells has exceeded extraction from shallow wells. About 1.7 billion cu m of water was withdrawn from the combination of shallow and deep wells during the period 1960-1980. The Nubian complex aquifer in the Kharga Oases has a very large groundwater potential that could be exploited and beneficially used for a long-term agricultural development in the area, provided proper well spacing and management are implemented. Other major environmental considerations for which precise hydrogeologic data are needed include: 1. Determination of the long-term yield available from properly constructed are producing artesian wells that will support a planned migration of population from the overcrowded Nile delta and flood plain areas. 2. Development of an effective management program and adequate staff to maintain groundwater production over an extended period of years. 3. The impact on climate caused by extensive irrigation in the oases of the Western Desert of Egypt. 4. Protection against water logging of soils from irrigation practices. 5. Protection against salinization of soils from irrigation practices. 6. Development of effective surface and subsurface drainage practices. 7. The impact of farming and pest control practices on the shallow groundwater of the oases. 8. Determination of the long-term development of the artesian water on the quality of the water from the aquifer systems in the Western Desert. This paper addresses items 1, 2, and 8. (Author's abstract)
W86-00554

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF SOIL EROSION ON SOYBEAN YIELDS AND CHARACTERISTICS OF CECIL-PACOLET SOILS,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 2J.
W86-00339

EFFECTS OF SOIL EROSION ON SOYBEAN PRODUCTION IN THE SOUTHERN PIEDMONT OF GEORGIA IN 1982,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. White, R. R. Bruce, A. W. Thomas, G. W. Langdale, and H. R. Perkins.
Erosion - Productivity Investigations, 1982, Research Report No. IRC 060183, June, 1983. 21 p, 5 Fig, 5 Tab.

Descriptors: *Erosion, *Soil erosion, *Rainfall, *Soil water, *Soybeans, *Crop production, *Plant growth, *Crop yield, Potassium, Magnesium, Soil conservation, Phosphorus, Erosion control, Soil horizons, *Georgia.

Twenty-four fields within a 25-mile radius of Watkinsville, Georgia were planted in soybeans to evaluate the effects of erosion on crop growth and production. Three plots within each field were classified as slightly, moderately, and severely eroded. Pedon descriptions were made to 60-inches deep for each erosion level and rainfall and soil water were measured twice weekly from mid-July to the end of the growing season. Results showed that erosion reduced plant growth, yields, and stands. Soybean yields averaged 41.3, 28.1, and 19.8 bushels/acre for the slight, moderate, and severly eroded areas, respectively. Both stover and bean yields were reduced 52% on the severely eroded areas compared to the slightly eroded sites. Soil tests on plow layer samples indicated that severely eroded sites had markedly lower levels of P compared to slightly eroded soils, while K and Mg were lowest on slightly eroded areas. Although complete interpretation of results are not possible at this time, these preliminary data present overall evidence indicating marked effects of erosion on soybean yields on these soils based on current agricultural practices.
W86-00340

BIOMASS OF MACROPHYTES IN THE CHANNEL RUNNING THROUGH AGRICULTURAL AREAS,
Polish Academy of Sciences, Poznan. Dept. of Agrobiology and Forestry.
For primary bibliographic entry see Field 2H.
W86-00436

HUMAN ECOLOGY OF THE JAMES RIVER,
Richmond Univ., VA. Dept. of Biology.
J. W. Bishop.
Virginia Journal of Science, Vol. 36, No. 1, p 14-18, 1985. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Environmental effects, *Water quality, *James River, *Virginia, Water pollution sources, Hydrologic cycle, Dam effects, Climate, Water supply, Water resources development.

The James River is part of the hydrologic cycle, which includes precipitation, evapotranspiration, surface runoff, and groundwater flow. People influence the supply of water both directly, as in the construction of reservoirs, and indirectly, as in the 'greenhouse effect', which affects climate, and therefore water supply. Following the James River from its headwaters on the Jackson River to its mouth demonstrates a pattern of increasing human involvement with the river, from farm ponds, to pumped storage electrical generation, to heavy industrial use. Water quality changes, generally for the worse, as the river progresses from relatively undeveloped to heavily developed areas. The river and the human population along its banks are interdependent. The population of the area, particularly at Richmond, has benefitted from the river, throughout history and can preserve the river for future use through employment of proper stewardship. (Rochester-IVI)
W86-00583

4D. Watershed Protection

BANK PROTECTION TECHNIQUES USING SPUR DIKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W86-00311

LONG ISLAND SOUND THAMESVILLE TIDAL-FLOOD MANAGEMENT WATER RESOURCES STUDY, NORWICH, CONNECTICUT.
Corps of Engineers, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA 120075. Reconnaissance Report, Stage 1, February 1981. 61 p. 7 Fig, 3 Tab, 4 Plates, 1 Append.

Descriptors: *Tidal floods, *Flood damage, *Floodproofing, *Flood protection, Thames River Basin, Connecticut, Planning, Economic aspects, Cost-benefit analysis, Interagency cooperation, Public policy.

The Thamesville area of Norwich, Connecticut, has the potential for severe flood damage from tides. This report identifies the problems, needs, and opportunities of the study area and the level of detail required to formulate any intermediate plans. Preliminary investigations have indicated that the Standard Project Hurricane (SPH) would cause enormous damage. An increase in future urbanization and encroachment on the flood plains can be expected to increase flood damages and magnify the problems the already exist. Protection of this area is feasible and would protect the immediate area from inundation. One environmental benefit would be the protection of the existing shoreline. Local interests consider protection against tidal flooding to be beneficial to the future development of the Thames River Basin and to the City of Norwich.
W86-00372

SEDIMENT LOSSES FROM CROPLAND FURROWS OF DIFFERENT GRADIENTS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2J.
W86-00467

SOIL LOSS FROM COTTON WITH CONSERVATION TILLAGE,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. K. Mutchler, L. L. McDowell, and J. D. Greer.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 160-163 and 168, January/February, 1985. 1 Fig, 3 Tab, 3 Ref.

Descriptors: *Soil erosion, *Soil loss, *Cotton, *Conservation tillage, Rainfall, Precipitation, Tillage, Erosion control,.

Erosion rates were documented and C-factors were calculated from conservation tillage for cotton grown on upland slopes. Three tillage systems for cotton were evaluated for erosion control effectiveness. Each of the three systems had two prior cropping histories. Soil loss ratios were computed for each crop stage to allow their use in the Universal Soil Loss Equation (USLE) for estimating soil loss from cotton. Soil loss from only the no-till cotton after no-till soybeans-wheat double-crop was below tolerable soil loss limits established by the Soil Conservation Service. Residue cover from cotton is less than from soybeans and corn, and the peculiar tap root system of the cotton plant contributes little to holding soil in place. The greatly beneficial effect of conservation tillage is seen in the comparison of plots conventionally tilled but with either an 11 year no-till or a conventional-till history. The no-till history apparently affected erosion because soil loss from conventional tillage was reduced by 47%, runoff reduced to 35% of the rainfall compared with 48% from long term conventional tillage, and seed cotton yield increased about 20%. (Baker-IVI)
W86-00497

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

GROUNDWATER MONITORING AND SAMPLE BIAS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7B.
W86-00345

REFINERY WASTEWATER PRIORITY POLLUTANT STUDY - SAMPLE ANALYSIS AND EVALUATION OF DATA.
Radian Corp., McLean, VA.
American Petroleum Institute, Washington, DC., December 1981. 342 p. 9 Fig, 33 Tab, 5 Ref, 5 Append.

Descriptors: *Oil wastes, *Gas chromatography, *Mass spectrometry, Isotope dilution, Internal standard, Atomic absorption spectroscopy, Inductively coupled argon plasma spectroscopy, Variability, Effluents, Chemical analysis, Benzenes, Organic compounds, Chloroform.

This report discusses the bias and within-laboratory precision of several analytical methods in order to assess reliably the magnitude and day-to-day variation of pollutants concentrations in two refinery wastewaters. Organic pollutants were determined by comparing two gas chromatography-mass spectroscopy techniques: 'isotope dilution' vs 'internal standard'. Elemental pollutants were analyzed by atomic absorption (AA) and/or inductively coupled argon plasma spectroscopy (ICAP). Much of the variability in measurements of final effluent concentrations is due to variability associated with the analytical methods currently available to measure effluent concentrations at the part-per-billion level of such priority pollutants as methylene chloride, benzene, toluene, chloroform, and phthalates. The two refineries were remarkably similar with respect to the pollutants present in the influent and effluent samples and the concentrations of these pollutants. The use of the isotope dilution procedure offered no advantage over the internal standard procedure in terms of eliminating between-laboratory bias or improving within-laboratory precision. The ICAP and AA methods of elemental analysis are essentially equivalent for measuring chromium and zinc in refinery wastewaters.
W86-00378

CHARACTERIZATION OF INDUSTRIAL AQUEOUS DISCHARGES BY THE TLC/AMES' ASSAY,
Sentralinstitutt for Industriell Forskning, Oslo (Norway).
M. Moller, L. H. Landmark, A. Bjorseth, and L. Renberg.
Chemosphere, Vol. 13, No. 8, p 873-879, 1984. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Pollutant identification, *Ames test, *Thin layer chromatography, *Industrial wastes, *Textile mill wastes, Organic compounds, Mutagens, Wastewater analysis, Textile industry.

The in situ detection of mutagens by the thin layer chromatography/Ames' assay has been applied to aqueous discharges from a textile plant. The samples were fractionated in acid/neutral and basic fractions which subsequently were subject to the TLC/Ames' test. The waste water contains a number of chemicals which for example are used as carriers and additives in order to improve the process and the products. The results of the study demonstrate that even if the mutagenic activity decreases in the presence of S9, the individual components may have increased activity. This illustrates the importance of separating the chemicals with different mutagenic properties. The mutagenic response was significantly lower for the basic fraction than for the acid/neutral fraction. Testing of the basic fraction in the presence of S9 did not reveal any mutagenic response significantly above the level of spontaneous revertants, hence the S9-mixture has completely deactivated the mutagens in the basic fraction. These results demonstrate the convenience of characterizing mutagenic compounds by the TLC/Ames' test. By simple chemical fractionation, standardized TLC conditions and various bio-assay systems, valuable information may be obtained prior to detailed chemical characterization by gas chromatography/mass spectrometry or other advanced analytical techniques. (Baker-IVI)
W86-00389

ION-SELECTIVE ELECTRODES (ISE) - RESEARCH INTO THE POTENTIAL REGULATION AND APPLICATION IN ANALYSIS (IONENSELEKTIVE ELEKTRODEN (ISE) - UNTERSUCHUNGEN ZUR POTENTIALEINSTELLUNG UND ANWENDUNG IN DER ANALYTIK),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
U. P. Decker, and R. Geyer.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 19-27, 1984. 4 Fig, 4 Tab, 9 Ref.

Descriptors: *Ion-selective electrodes, *Water analysis, Water treatment, Iodides, Sulfides, Cyanides, Chlorides, Electrodes, Water quality control.

The necessity for the use of ion-selective electrodes in the water-control practice and for process control in water treatment processes is explained. After the description of the general construction principle of measuring systems for recording potential differences, special data and details are presented concerning the composition of the ion-selective electrodes. The principle of operation and the dependence on special conditions are described using theoretical considerations as examples. The following detection sensitivities with ion-selective electrodes (solid membranes) are given: iodide 0.01- 0.0000001; sulfide 0.01-0.000001; and cyanide 0.01-0.00001 mol/l. It may also be possible to detect chloride concentrations lower than 0.00001 mol/l with the aid of ion-selective electrodes on a solid membrane basis. (Author's abstract)
W86-00395

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF TRIAZIN HERBICIDES IN WATER (DUNNSCHICHTCHROMATOGRAPHISCHE BESTIMMUNG VON TRIAZINHERBIZIDEN IN WASSER),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
D. Lienig, B. Wiemer, and I. Zolfel.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 29-37, 1984. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Thin-layer chromatography, *Herbicides, *Triazine, Water analysis, Chromatography, Pollutant identification.

A description is given of thin-layer chromatographic determination of Triazine herbicides after chloroform extraction and detection with 0.1 N AgNO3 solution and irradiation by ultraviolet light. For simazine, Atrazine and Prometryne, the detection limits are at 0.05 micro-g. Disturbances can be avoided if two different mobile solvents are used and preliminary clean-up by thin-layer chromatography is done. The agreement of the Rf-values in two different mobile solvents with the Rf-values from known standard solutions is used as the criterion of identification. (Author's abstract)
W86-00396

POSSIBILITIES OF THE CORRELATION OF DIFFERENT WATER ANALYSIS METHODS (MOGLICHKEITEN DER KORRELATION UNTERSCHIEDLICHER WASSERANALYSENVERFAHREN),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
F. Winkler, B. Duwert, and H. Patecki.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 239-246, 1984. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Wastewater treatment, Surfactants, Organic carbon, Chemical oxygen demand, Biochemical oxygen demand, Industrial wastewater.

The regressions and correlations between TOC, COD-Cr, COD-Mn, BOD5 and CHCl3-extract were investigated for model waters containing Prawozell W-ON 100 and Emulgator 30 as the most important tensides (synthetic surface active agents) as well as for the actual clarification plant influents of a chemical works. As expected, for the model waters in all cases highly significant regressions exist between the results of the different investigation methods. For the actual wastewater there can be demonstrated statistically secured connections with degrees of determination of 0.64-0.78 only for the pairs TOC - COD-Cr, BOD5 - COD-Cr, COD-Mn - COD-Cr and TOC - COD-Mn, due to the varying composition. The corresponding regression equations with their range of definition are given. They can contribute to rendering the acquisition of measured values more efficient and to control the wastewater treatment. (Author's abstract)
W86-00411

DETERMINATION OF SULFIDE IN WATER BY MEANS OF AN ION-SELECTIVE ELECTRODE (BESTIMMUNG VON SULFID IN WASSER MIT EINER IONENSELEKTIVEN ELEKTRODE),
Wasserwirtschaftsdirektion Saale-Werra, Halle (German D.R.).
H.-J. Neidhardt, and H. D. Steinleitner.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 247-253, 1984. 1 Fig, 17 Ref.

Descriptors: *Sulfides, *Ion-selective electrodes, *Water analysis, Potentiometry, Titration.

For the direct potentiometric measurement by means of a sulfide-selective solid-state membrane electrode (such as the reference electrode - a calomel electrode with a salt bridge filled with 1M KNO3-solution) a 25 ml sample is mixed with 25 ml sulfide-antioxidant buffer (0.2 M ascorbic acid in 2 M NaOH, Ag2S-saturated). Calibration is done with thioacetamide in the same buffer. This measuring arrangement determines sulfide concentrations of 0.0000015 to 0.001 M. If the buffer is added to the samples in the ratio of 1 + 1 during sampling, the sulfide content will be stabilized for at least 24 h. The measuring method and its calibration are compared with other methods of calibration with Na2S and potentiometric titration, idometric titration and photometric determination. The method developed proved to be very selective and requires a minimum expenditure of time. (Author's abstract)
W86-00412

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF MINERAL OIL IN WELL WATER (DUNNSCHICHTCHROMATOGRAPHISCHER NACHWEIS VON MINERALOL IN BRUNNENWASSER),
Bezirks-Hygieneinspektion und -Inst., Erfurt (German D.R.).
K. Machmerth.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 479-489, 1984. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Thin-layer chromatography, *Water analysis, *Mineral oil, *Well water, Pollutant identification, Drinking water, Chromatography.

A tabular survey is given from literature concerning seven extraction techniques, 14 thin-layer chromatographic detection techniques and 15 spray reagents. From the possibilities represented in this way, a newly composed method is described which can be carried out in any routine laboratory within one hour and has proved successful in situations of average of the drinking water supply. One l water is extracted with 25 ml CCl4, the extract is concentrated in the vacuum to 1 ml and chromatographed with n-hexane on a prefabricated foil. Detection is carried out with 10% methanolic molybdophosphoric acid. The detection limit is at 0.5 micro-g. (Author's abstract)
W86-00415

ANALYSIS OF CHLOROPHENOXYALKANE ACIDS AND CHLOROPHENOLS. PART 2: DETECTION OF CHLOROPHENOXYALKANE ACIDS AND CHLOROPHENOLS IN THE FISH BILE (ZUR ANALYTIK VON CHLORPHENOXYALKANSAUREN UND CHLORPHENOLEN. TEIL 2: NACHWEIS VON CHLORPHENOXYALKANSAUREN UND CHLORPHENOLEN IN DER FISCHGALLE),
Bezirksinstitut fuer Veterinarwesen Karl-Marx-Stadt (German D.R.).
K. Grahl, and H. Hermenau.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 491-497, 1984. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Chlorophenoxyalkane acids, *Chlorophenols, *Fish, *Chromatography, Pollutant identification, Herbicides, Thin-layer chromatogra-

phy, Monitoring, Pesticide residues, 2,4-D, MCPA, MCPP, Dichlorophenols, Methylchlorophenols.

The bile liquid is preserved with ethanol and the protein is precipitated. Prefractionation is done by liquid-liquid extraction using chloroform and ethyl acetate. The extracts are separated on Florisil with column-chromatography and subsequent detection by thin-layer chromatography. To determine the identity of substances, the penta fluorobenzyl derivatives are prepared and chromatographed under the same conditions. Detection is carried out with the aid of ammoniacal silver nitrate reagent and ultraviolet irradiation. The highly polar conjugates of chlorophenoxyalkane acids and chlorophenols which are present in the bile are cracked by acid hydrolysis and then cleaned-up by re-extraction. Using this method, 2,4-D, MCPA, MCPP, 2,4-dichlorophenol and 2-methyl-4-chlorophenol were detected from Salmo gairdneri; 6-21 d after the application of the herbicides in the catchment area their concentration in the fish bile amounted to about 200 mg/l, 90% of them were conjugates. Thus, the biliary excretion of xenobiotic substances offers an important new aspect of biomonitoring with fish tests, especially in the range of subacute and chronic toxicity. (Author's abstract)
W86-00416

MODEL ECOSYSTEMS AS A TOOL IN FRESHWATER AND MARINE RESEARCH,
National Swedish Environment Protection Board, Solna.
A. Lundgren.
Archiv fur Hydrobiologie, Suppl. 70, No. 2, p 157-196, 1985. 9 Fig, 1 Tab, 144 Ref.

Descriptors: *Reviews, *Ecosystems, *Water pollution, *Model studies, Microcosms, Toxicity, Biodegradation, Biological magnification, Ecology, Food chains, Fate of pollutants, Water pollution effects.

This review is a survey of recent studies in aquatic ecotoxicology and experimental ecology, where model ecosystems were used as test systems and is an attempt to provide both theoretical and practical aspects on the strategy of model ecosystem design. Small synthetic laboratory microcosms are easily replicated and well suited for standardization. Two examples are described representing the model ecosystems and the model food chain. These microcosms are characterized by a very simplified structure and a reduced number of biotic and abiotic interactions and can not be regarded as models of any specific natural ecosystem. Experiments in small laboratory microcosms can, however, provide information on general ecosystem behavior and give quantitative indexes on biodegradability of chemical substances, ecological magnification, etc. If information on fate and effects of toxic chemicals on more specific natural ecosystems is needed, much more complex model ecosystems must be used. This is easiest done by isolating a part of a natural ecosystem. Different large-scale model ecosystems covering pelagic bags, benthos enclosures, enclosures of the profundal zone, combination enclosures with both benthic and pelagic communities and experimental ponds and lakes are described. The artefacts introduced by enclosure and scaling are discussed together with different ways to minimize their effects. The controversy between realism and replication is discussed and it is finally concluded that experiments in large-scale model ecosystems can provide valuable information on the fate and effects of pollutants in natural ecosystems. (Author's abstract)
W86-00526

BIOMONITORING OF THE CONTAMINATION OF WATER BY A SUBLETHAL CONCENTRATION OF PESTICIDES - A SYSTEM ANALYSIS APPROACH,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, and I. P. Tonk.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 399-409, 1984. 5 Tab, 32 Ref.

Descriptors: *Monitoring, *Bioassay, *Pesticides, *Systems analysis, Heteropneustes, Chlordane, Aldrin, Metasystox, Dichlorvos, Carbofuran, Sevin, Enzymes, Respiration.

Heteropneustes (Saccobranchus) fossilis (Pisces; Clariidae) was exposed to the biocides Chlordane, Aldrin, Metasystox, Dichlorvos, Carbofuran and Sevin for 30 d at a concentration of the 1/5 fraction of LC50;96h with daily exchange of the medium. At intervals of 5 d the respiration rate was determined for 1 h. In addition, after the end of tests 13 hematological parameters as well as the activities of the adenosine triphosphatases and acetylcholinesterase were determined in the liver, the kidney and the gills. During all exposures to biocides the respiration rate decreases significantly with the test time. At all exposures the blood concentrations of glucose, sodium- and chloride-ions show a significant increase, whereas the cholesterin content and the clotting time decrease significantly. The ATPase activity is significantly reduced only by Aldrin and Cholordane. A significant reduction of the acetylcholinesterase activity occurs in each of the three investigated tissues only for Metasystox and Dichlorvos and in the liver in addition also for Chlordane, Aldrin and Carbofuran. Therefore, the respiration rate and hematological criteria permit a general stress indication, enzymatic activities constitute a specific indication of individual groups of biocides, so that a systematic analysis of these three indication groups will probably provide a specific resultant statement in a biomonitoring system due to the specific inhibition pattern. (Author's abstract)
W86-00542

METHOD FOR DETERMINING AMMONIA NITROGEN IN WATERS (METHODE ZUR BESTIMMUNG DES AMMONIAKSTICKSTOFFES IN GEWASSERN),
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
I. Hoffmann, B. Nagy, and J. Schneider.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 645-651, 1984. 1 Fig, 9 Ref.

Descriptors: *Ammonia, *Water analysis, *Spectrophotometry, Nitrogen, Lake Balaton, Hungary.

For the spectrophotometrical determination of ammonia in surface water the reaction with hypochlorite and thymol in alkaline solution is used. Compared with other techniques, expenditure is low, the reagents are stable for a long period of time and the reaction is little dependent on external conditions. In 2 cm cuvettes there can be determined 0.05-0.5 mg/l ammonia nitrogen. Comparative investigations carried out at nine sites in the area of the lake Balaton have revealed concentrations of 0.2-0.7 mg/l ammonia nitrogen. (Author's abstract)
W86-00550

PHYSIOLOGICAL RESPONSES TO POLLUTION,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5C.
W86-00597

STATE MUSSEL WATCH: TOXICS SURVEILLANCE IN CALIFORNIA,
California State Dept. of Fish and Game, Monterey.
M. Martin.
Marine Pollution Bulletin, Vol. 16, No. 4, p 140-146, April, 1985. 5 Fig, 5 Tab, 25 Ref. NOAA grant NA 81 AAHCZ 162.

Descriptors: *Monitoring, *Bioaccumulation, *Mussels, *California, Toxicity, Coastal waters, Trace metals, Polychlorinated biphenyls, Silver, DDE, Toxaphene, Endosulfan I, Pesticides, Lead, Copper, Zinc.

The California State Mussel Watch Program is described and an explanation is given as to where mussel watch findings have been used in regulatory or abatement action on trace toxic substances. Results of coastal monitoring of trace toxic substances are reported along with the biological effects measurements in synoptic studies of San Francisco Bay, chemical and biological monitoring at a major wastewater discharge in southern California, and the use of mussel watch data in regulation of toxics discharge to California marine and estuarine waters. Chromium, copper and zinc concentrations in mussels are consistently higher at stations near major southern California wastewater discharges. Lead levels were elevated in the southern California area. There was an unexpected hot spot found in Monterey Bay, central California, which caused a special intensive site study. Elevated concentrations of p,p'-DDE were found in the Southern California Bight. Mussels collected from South San Francisco Bay near Redwood Creek had high levels of silver in earlier investigations. In the 1983-84 study, a source for this elevated level was not found. Mussels collected from Moss Landing Harbor and Elkhorn Slough contained the highest concentration of toxaphene and endosulfan I. At the state level, California uses the Water Quality Control Plan for Ocean Waters of California to regulate waste discharge to ocean waters. The United States National Oceanic and Atmospheric Administration recently initiated a program called the National Status and Trends Program in response to a general concern about the potential for bioaccumulation of synthetic organic pollutants in marine/estuarine areas of the US. The NOAA Status and Trends program contains a mussel watch component to produce data that will be collected, and be incorporated in reports of pollutant conditions in the nation's marine waters. (Baker-IVI)
W86-00598

5B. Sources Of Pollution

CALCIUM CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5C.
W86-00309

FERRIC CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5C.
W86-00310

CHLORINE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5C.
W86-00319

COASTAL MARINE RESOURCES INVENTORY, 1983: PEMAQUID POINT TO SPRUCE HEAD,
Maine State Dept. of Marine Resources, West Boothbay Harbor. Marine Resources Lab.
For primary bibliographic entry see Field 5C.
W86-00322

SOURCES, CHEMISTRY, FATE, AND EFFECTS OF CHROMIUM IN AQUATIC ENVIRONMENTS.
Ecological Analysts, Inc., Sparks, MD.
American Petroleum Institute, Washington, DC., November, 1981. 191 p. 22 Tab, 210 Ref.

Descriptors: *Reviews, *Chromium, *Fate of pollutants, *Water pollution sources, *Water pollution effects, *Toxicity, *Water quality standards, *Pollutant identification, Heavy metals, Metals, Bioaccumulation, Uptake, Nonpoint pollution sources, Aquatic animals, Aquatic plants, Industrial wastes.

A comprehensive body of information on detection, chemistry and fate, principal sources, and biological effects of Cr in surface waters is present-

ed in context with regulatory applications for the control of Cr discharges. Analytical methods for Cr determination are described and evaluated. The chemistry of Cr in water is discussed as it relates to biological availability. The effects of hydrolysis, speciation, precipitation, adsorption, and bioaccumulation in determining the fate of Cr are discussed. The most recent data available on industrial and publicly owned treatment-works point-source contributions of Cr to surface waters are assessed and estimates are provided. Anthropogenic nonpoint sources are also mentioned. The effects of Cr ingestion on human health and its role in human nutrition are presented. A comprehensive review of the effects of Cr on aquatic organisms includes data on acute and chronic toxicity and bioaccumulation. Biotic and abiotic factors which affect Cr toxicity and uptake are discussed. A review of federal Cr criteria and the technical rationale behind their development is presented along with a listing of current state water quality criteria and standards. The existing regulatory framework concerning the discharge of Cr in industrial point source effluents is discussed with emphasis on how regulatory agencies can use aquatic toxicity data to derive water quality criteria.
W86-00344

VERIFICATION AND TRANSFER OF THERMAL POLLUTION MODEL; VOLUME IV: USER'S MANUAL FOR THREE-DIMENSIONAL RIGID-LID MODEL,
Miami Univ., Coral Gables, FL. Dept. of Mechanical Engineering.
S. S. Lee, S. Sengupta, E. V. Nwadike, and S. K. Sinha.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116103. Report EPA-600/7-82-037d, May 1982. 145 p. 8 Fig, 6 Tab, 4 Ref, 2 Append. Contract/Grant No. NAS 10-9410.

Descriptors: *Computer models, *Thermal pollution, *Mathematical models, Lake basins, Lakes, Computer programs, Path of pollutants.

The three-dimensional rigid-lid model was developed by the thermal pollution group at the University of Miami and verified for accuracy at Lake Keowee, South Carolina. The model results were fairly accurate in all the verification runs. The model is intended to be used for hydrothermal predictions of closed basins subjected to a heated discharge together with various other inflows and outflows. This manual has been written to enable any user to be able to apply it without difficulty. Derivation of the governing equations and various other details have been omitted.
W86-00346

TRANSPORT, FATE AND EFFECTS OF ENERGY-RELATED POLLUTANTS: EVALUATION OF SURFACE AND GROUNDWATERS; APPENDIX 1: PRELIMINARY LISTING OF SENSITIVE SURFACE WATERS,
Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
G. R. Hendrey, H. C. Thode, and N. Gmur.
Available from the National Technical Information Service, Springfield, VA 22161 as No. DE82016614. Second Progress Report, September 1981. BNL-51473, Volume 2. 130 p. 31 Fig, 17 Tab, 18 Ref, 2 Append. Contract/Grant No. DE-AC02-76CH00016.

Descriptors: *Acidic water, *Alkalinity, *Water quality, *Acid rain, Conductivity, Hydrogen ion concentrations, Water pollution effects, Groundwater, Surface Water.

The sensitivity of freshwaters of the eastern United States to acidification was evaluated by identifying and mapping specific sites at which low alkalinity or pH may exist, or at which there has been an increase in acidity or decrease in alkalinity. Efforts have been concentrated on the acquisition of new water quality data for inclusion in the Acidification Chemistry Information Database (ACID), on expanding the list of chemical variables in the database, on devising statistical methods for examining and improving the quality of the component data sets, and on analyses of temporal trends in water quality for selected states. Analyses of seasonal patterns in chemical variables are in progress as part of the temporal trend analysis. So far, > 3,500 stations have been provisionally identified as sensitive to acidification (alkalinity < or = 0.1 meq/liter. Data in ACID also indicate that 669 stations have statistically significant long-term decreases in alkalinity (further verification is required). State-by-state maps locating these stations are presented. This progress report also describes the current contents and status of ACID, presents results of searches for erroneous data, and describes ongoing and planned quality control procedures.
W86-00348

ENVIRONMENTAL RISK ASSESSMENT: THE POTENTIAL ROLE OF MICROBIAL EFFECTS TESTING,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
For primary bibliographic entry see Field 5C.
W86-00353

CHLORINATED PHENOLS AS CONTAMINANTS OF SOIL AND WATER IN THE VICINITY OF TWO FINNISH SAWMILLS,
Helsinki Univ. (Finland). Dept. of General Microbiology.
R. Valo, V. Kitunen, M. Salkinoja-Salonen, and S. Raisanen.
Chemosphere, Vol. 13, No. 8, p 835-844, 1984. 3 Fig, 5 Tab, 17 Ref.

Descriptors: *Saw mills, *Fungicides, *Water pollution sources, *Chlorophenols, Phenols, Surface water, Groundwater pollution, Leaching, Organic compounds, Fate of pollutants, Finland.

All the wood exporting sawmills in Finland use fungicide for preserving freshly sawn timber and lumber against losses during storage and shipment. The results of a study on the occurrence of chlorinated phenols at and around two Finnish sawmills, both of which used a typical wood preserving method, are reported. One mill (A) had been using chlorophenolic wood preservative for 2 seasons and mill B for 20 seasons. Mill A used a preserving method in which the lumber was not placed in a trickling basin after dipping. Mill B had a trickling basin for treated lumber. Soil around the basin was heavily contaminated. At mill A concentration of 70 mg chlorophenols/kg soil was found near the treatment basin while the figure for the same area at mill B was 30 mg/kg. The soil in the storage area for preserved wood contained up to 6 mg/kg at A and 1 mg/kg at B. The vertical distribution of chlorophenols in the soil was uneven, indicating that chlorophenols accumulate in certain layers more than in others. The main components of the wood preserving solution, 2,4,6-TCP, 2,3,4,6-TeCP and PCP, were usually the most abundant in soil at most sites. Polychlorinated phenols are thus stable in the sawmill surroundings. Groundwater samples taken from the vicinity of mill A were found to contain from 1.6 to over 20,000 micro-g of chlorophenols per liter, while the concentration detected in a nearby lake was only 40 ng/l. Contamination of household wells by the direct flow of groundwater from the dipping basin is improbable, because the water level in those wells was above the dipping basin. Leaching of chlorophenols from the storage area or transport through the air are more probable ways for the contaminants to spread. (Baker-IVI)
W86-00387

TETRACHLORODIBENZO-P-DIOXINS AND TETRACHLORODIBENZOFURANS IN ATLANTIC COAST STRIPED BASS AND IN HUDSON RIVER FISH, WATERFOWL AND SEDIMENTS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
P. O'Keefe, D. Hilker, C. Meyer, K. Aldous, and L. Shane.
Chemosphere, Vol. 13, No. 8, p 849-860, 1984. 3 Tab, 26 Ref.

Descriptors: *Tetrachlorodibenzo-p-dioxin, *Tetrachlorodibenzofuran, *Bass, *Fish, *Hudson River, *New York, Dioxins, Water pollution sources, Chlorophenols, Polychlorinated biphenyls, Chlorinated hydrocarbons.

The extent of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlroodibenzofuran (2,3,7,8-TCDF) contamination of various populations of Atlantic Coast striped bass including fish from the Hudson River was examined. There was no evidence of contamination by 2,3,7,8-TCDD or 2,3,7,8-TCDF in samples of brook trout from a hatchery, with limits of detection varying from 0.6 to 2.2 ppt. Analytical results showed the 2,3,7,8-TCDD concentration in the striped bass from the Hudson River and its estuary to be significantly higher than the concentrations present in striped bass from Chesapeake Bay and Rhode Island coastal waters. A similar result was obtained from 2,3,7,8-TCDF, although the level of significance was reduced. The finding that concentrations of 2,3,7,8-TCDD greater than 5 ppt are confined to fish from the Hudson River should be considered in relation to the life cycle of the species. An effective program to control 2,3,7,8-TCDD/2,3,7,8-TCDF in the Hudson River striped bass population will require a knowledge of the sources of the contaminants to the river. Tentative findings suggest that these contaminants do not appear to be associated with a source in the upper Hudson River such as those previously described in polychlorinated biphenyl discharges. The presence of 2,3,7,8-TCDD as the only TCDD isomer in the sediment and fish suggests that the source of contamination is a chemical such as trichlorophenol where 2,3,7,8-TCDD is the only PCDD isomer which can be readily detected. Polychlorinated biphenyls are a possible source for 2,3,7,8-TCDF, with the documented evidence for preferential bioaccumulation of 2,3,7,8 substituted isomers accounting for the absence form the fish tissue of the other TCDF isomers found in the sediment. The similar concentrations in the fish over a 2 year period suggests that there is a constant exposure level in the river, but evaluation of sources requires additional data. (Baker-IVI)
W86-00388

DISTRIBUTION AND RATE OF DISAPPEARANCE OF FLUORENE IN POND ECOSYSTEMS,
Columbia National Fisheries Research Lab., MO.
T. P. Boyle, S. E. Finger, J. D. Petty, L. M. Smith, and J. N. Huckins.
Chemosphere, Vol. 13, No. 9, p 997-1008, 1984. 3 Fig, 2 Tab, 35 Ref.

Descriptors: *Fluorene, *Ponds, *Fate of pollutants, Distribution, Evaporation, Degradation, Sediments, Macrophytes, Ecosystems, Trophic level, Phytoplankton, Dissolved oxygen.

The environmental fate of fluorene applied at different concentrations to various experimental pond ecosystems was examined with emphasis on estimating the role of several physical, chemical, and biological factors in determining the relative distribution of fluorene in aquatic ecosystems and examining the use of the chemical parameters of fluorene to predict relative rates of its disappearance. Fluorene rapidly disappears from freshwater pond ecosystems. This disappearance is considered to have occurred in two modes: evaporation and sublimation from the surface of the pond, and degradation of the parent compound. Most of the fluorene applied to the ponds was not accounted for by the measurements taken in water, mud and plants. The trophic state of a lentic ecosystem may affect a number of environmental variables that also play important roles in determining the persistence of a chemical contaminant. Two factors connected with the level of productivity were significantly associated with the rate of fluorene disappearance: the density of phytoplankton as indicated by chlorophyll a, and the dissolved oxygen concentration at dawn. The rate of disappearance of fluorene was also linked to differences in productivity. Where the mean level of chlorophyll a was high, the rate of fluorene disappearance was also high; when the oxygen concentration over the nocturnal period, as

indicated by an early morning measurement, dropped low enough, fluorene degradation was retarded. The results of this study imply that eutrophic lakes and ponds are better able to degrade organic compounds such as fluorene than are oligotrophic systems. Moreover, aquatic environments with low dissolved oxygen concentrations may potentially have lower degradation potentials. (Baker-IVI)
W86-00391

CASE OF POLYCHLORINATED BIPHENYL CONTAMINATION OF WATER AND SEDIMENT IN THE SLOVENIAN KARST REGION (YUGOSLAVIA),
Maribor Inst. of Public Health (Yugoslovia).
S. Brumen, M. Medved, E. Voncina, and J. Jan.
Chemosphere, Vol. 13, No. 11, p 1243-1246, 1984. 2 Fig, 8 Ref.

Descriptors: *Polychlorinated biphenyls, *Fate of pollutants, *Karst hydrology, *Slovenia, *Yugoslavia, Industrial wastes, Waste disposal, Sediments, Water analysis, Chlorinated hydrocarbons,.

An incident is described in which polychlorinated biphenyls (PCBs) from an electro-industrial plant waste dump draining into groundwater channels in karst terrain have contaminated a potable water source. PCB composition data were obtained using quadropole GC-MS and capillary GC. The average level of PCBs determined in water was 0.3 micro-g/l and in sediment was 55 micro-g/g. From the negligible decline of degradable PCBs relative to the more persistent components, the impression is given that PCBs in a karst environment are rather stable. The decline of some lower chlorinated components in the PCB profile of sediment is more pronounced and could be explained as due to some physico-chemical effects such as lower incorporation into the sediment, transportation to air, release to water, and higher susceptibility to degradation. (Baker-IVI)
W86-00392

COPPER, ZINC, CADMIUM, AND LEAD IN SCALLOPS (PLACOPECTEN MAGELLANICUS),
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
S. Ray, M. Woodside, V. E. Jerome, and H. Akagi.
Chemosphere, Vol. 13, No. 11, p 1247-1254, 1984. 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Scallops, *Bays, *Georges Bank, *Browns Bank, *Bay of Fundy, *Copper, *Zinc, *Cadmium, *Lead, Metals, Fate of pollutants, Fish.

The total body burden of Cd for similar sized scallops from Georges and Browns Banks ranged from 135 to 245 micro-g compared with only 71 micro-g for scallops from the Bay of Fundy. The concentrations of Cd in individual tissues in all cases were also higher than those for Bay of Fundy scallops. Such differences did not occur for Cu, Zn, and Pb. The high body burden of Cd in scallops from Georges and Browns Banks far away from any known source of anthropogenic input is surprising and suggests a natural origin. The observation that Cd concentrations in medium sized animals are significantly lower than in either smaller or large animals has not been reported previously and possible physiological factors controlling it should be examined. It is not known whether high levels of the metal in the various tissues cause any physiological damage to the scallop but complete absence of large scallops from Browns Bank and their relative scarcity from George Bank may be related to the high body burden of Cd. There is also the possibility that the absence of large scallops may be related to the intense fishing in the area. (Baker-IVI)
W86-00393

INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Bezirks-Hygieneinspektion und -Inst., Potsdam (German D.R.).
L. Kalbe.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 145-152, 1984. 5 Tab, 25 Ref.

Descriptors: *Carp, *Aquaculture, *Eutrophication, Phytoplankton, Zooplankton, Lake sediments, Chlorophyll, Primary productivity, Cycling nutrients, Aquatic plants, Galenbeck Lake.

In Galenbeck lake, a shallow lake covering 700 ha and having a nutrient load of 0.23 g/sq ma P and 4.3 g/sq ma N, in 1965 a stock of 500 carp/ha was established and fed with grain. This stock of carp resulted in a considerable disturbance and redeposition of the soft lime sediments; the rich submersed vegetation disappeared and the phytoplankton reached a maxima of 885,420 cells/ml, whereas the zooplankton reached only 4530 ind./l. The chlorophyll content increased to 464 mg/cu m, and the depth of visibility decreased to 10 cm. The total planktonic primary production is estimated at at least 500 g/sq ma C. These changes are regarded as eutrophication, caused mainly by internal fertilization by an intensified recirculation of nutrients from the sediment, but also by the fertilization which is connected with feeding. The fish rearing ceased and the stock of carp was fished off; in 1970 a restoration of the lake began, and in 1974 the lake again reached its original state as a clear-water lake with an abundant population of macrophytes, supported by the P-retention in an upstream storage reservoir for spray-irrigation water. (Author's abstract)
W86-00406

PROBLEM OF INTENSIVE CARP REARING IN LAKES AND EUTROPHICATION (ZUR FRAGE DER KARPFENINTENSIVBEWIRTSCHAFTUNG VON SEEN UND EUTROPHIERUNG),
Institut fuer Binnenfischerei, Berlin (German D.R.).
D. Barthelmes.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 153-161, 1984. 24 Ref.

Descriptors: *Carp, *Aquaculture, *Eutrophication, Macrophytes, Aquatic plants, Periphyton, Phytoplankton, Lake sediments, Galenbeck Lake.

Normally, carp rearing at medium densities is connected with the promotion of daphnia and filtration effects up to 'clear-water states'. Because of the reduction of submerged plants and of the periphyton, this form of carp rearing should be possible in eutrophic shallow lakes with a slight nutrient introduction without any considerable eutrophication. Due to the deterioration of the light climate by re-suspension of the sediment, even reductions in primary production are possible. In the case of Galenbeck Lake a drastic reduction of submerged macrophytes occurred in connection with an increased development of plankton, only general estimations being available of the shares of macrophytes and phytoplankton in the overall production. The phytoplankton increase is perhaps caused by the absence of filtering zooplankton due to an insufficient reduction of the indigenous fish stocks. In Galenbeck Lake, the structural changes in the ecosystem were due both to the high degree of resuspension of the very mobile lime sediment and the absence of hard bottom areas, which made the total reduction of the macroflora possible. (Author's abstract)
W86-00407

SIMULATION OF NITRATE DEGRADATION IN GROUNDWATER (SIMULATION DES NITRATABBAUS IM GRUNDWASSER),
Institut fuer Binnenfischerei, Berlin (German D.R.).
M. Schwan, D. Kramer, and C. Gericke.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 163-171, 1984. 2 Tab, 11 Ref.

Descriptors: *Groundwater pollution, *Nitrates, *Degradation, *Simulation, Groundwater recharge, Wastewater disposal, Diffusion, Convection, Kinetics, Differential equations, Model studies.

Ten reaction vessels containing 1 cu m were used as the experimental arrangement. They were filled with coarse sand or fine gravel and installed 60 cm below the floor. The pore volume (water saturation) was 227-260 l. Anaerobic conditions were established by the addition of 6 g glucose at storage. The reactors were given tap water with 50 and 200 mg/l NO-3 from KNO3 in such a way that a volumetric rate of flow of 0.2, 0.4 and 0.8 l/d was created. The volumetric rates of flow corresponded to the natural recharge of groundwater, the recharge of groundwater under the conditions of irrigation and the conditions of an intensive wastewater ground treatment. In the effluent from the reaction vessels the nitrate concentration was determined every month. It was stationary from the 7th to the 55th month after the beginning of the experiment. The experiments are evaluated by means of a model which takes into account the diffusion, convection and kinetics of the nitrate degradation according to Michaelis-Menten. A simple method for solving homogeneous non-linear differential equations of the second order is proposed. The experimental and model results show a good agreement and prove the very slow nitrate degradation in the groundwater with kM = 210 mg/l, v max = 1.5 mg/l.d or k1 = 0.005/d. (Author's abstract)
W86-00408

INDICATOR BACTERIA IN WATER AND STREAM SEDIMENTS NEAR THE SNOWY RANGE IN SOUTHERN WYOMING,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
H. L. Gray, and J. C. Adams.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 133-144, June, 1985. 4 Fig, 3 Tab, 21 Ref.

Descriptors: *Bioindicators, *Bacteria, *Stream pollution, *Sediments, *Wyoming, Fecal coliforms, Fecal streptococci, Water pollution sources, Coliforms, Pollutant identification, Grazing, Recreation.

Water samples were taken at eight pools in streams in the Nash Fork watershed after snowmelt in the summer of 1980. The watershed is below the Snowy Range escarpment, and principal land uses include skiing and other winter sports, sheep and cattle grazing, camping and fishing, and summer homes. Water taken before and after disturbing stream bottom sediment were analyzed for fecal coliforms (FC) and fecal streptococci (FS). FC counts in undisturbed pool influent water ranged from 0 to 30 colonies per 100 mL of water. The FC densities were less than 1 colony per 100 mL of water in only 10 of 24 samples taken during the 3 month study. The streamwater was questionable for drinking without treatment, but was suitable for all other recreational uses. The main sources of FC were sheep and cattle. Stream sediment was not a source. Study sites most impacted by recreation use had low FC densities. Only one site, crossed by the band of 1000 sheep in August, was seriously degraded by fecal contamination. Within a period of one month, and in the absence of continued fecal contamination, bacterial counts on the stream moss samples decreased from 2500 GC per g of wet moss in August to 5 FC in September. FS counts in the undisturbed pool influent water ranged from 6 to 590 colonies per 100 mL of water and were also highest at sites most impacted by sheep and cattle. FS densities ranged from 1.1 to 19.5 times greater in the pool effluent than in the influent water. The sediment appeared to have harbored FS bacteria that had survived and/or multiplied. No significant evidence was found for major long-term, cumulative increases in bacterial densities in stream water and bottom sediment due to past and present sheep and cattle grazing and recreation use. The levels of FC and FS densities associated with present land uses will likely remain relatively constant from year to year because of long winters, annual streamflow replenishment from the melting snowpack, and scouring of streams as a result of high spring and summer runoff. (Baker-IVI)
W86-00428

SEDIMENT ACID NEUTRALIZATION IN SOFTWATER LAKES,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 2H.
W86-00432

IMPACT OF THE SILVER CARP (HYPOPHTHALMICHTHYS MOLITRIX VAL.) ON THE ECOSYSTEM OF CARP PONDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland). Dept. of Pond Management.
W. Piotrowska-Opuszynska.
Ekologia Polska, Vol. 32, No. 2, p 307-339, 1984. 10 Fig, 5 Tab, 58 Ref.

Descriptors: *Fish farming, *Silver carp, *Fish ponds, *Physicochemical properties, Aquaculture, Dissolved oxygen, Chlorophyll, Carp, Primary productivity, Phytoplankton.

The effect of the silver carp on the physico-chemical conditions of the carp pond habitat was studied. A determination was also made of the mechanisms via which it modified the habitat. The presence of the silver carp brought about significant changes in the physico-chemical and biocoenotic conditions of the ponds. In all cases, an increase was found of chlorophyll content in the water and a higher primary production, relative to the control ponds stocked with carp alone. The loading of the water with organic matter increased, this being indicated by the amount of nitrogen, phosphorus and organic carbon. The level of mineral compounds was lower. As densities of silver carp increased, the level of oxygen in the water rose. With silver carp larvae, the content of chlorophyll in the water was higher, and so was the primary production, the amount of oxygen was lower than in the control ponds. This is attributed to the lack of organic matter elimination by the silver carp larvae. The silver carp caused an intensive growth of the phytoplankton via a complex effect on the ecosystem. Although it did not fulfill the original hopes concerning the control of water eutrophication, the silver carp played a positive role as a factor taking part in the control of the living conditions of the fish in the ponds. It gave an additional piscicultural production due to a better utilization of the food resources of the habitat. It may be considered a species desirable in fish farming, especially in carp ponds. (Baker-IVI)
W86-00439

SEDIMENT COMPOSITION FOR NONPOINT SOURCE POLLUTION ANALYSES,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
G. R. Foster, R. A. Young, and W. H. Neibling.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 133-139 and 146, January/February, 1985. 5 Fig, 2 Tab, 23 Ref. DOE contract W-7405-ENG.36.

Descriptors: *Nonpoint water pollution sources, *Pollutant analysis, *Path of pollutants, *Sedimentation, Soil properties, Clay, Silt, Aggregates, Sand, Mathematical equations, Model studies.

A report is offered of the development of relationships for sediment distributions and the composition of aggregates near the point of detachment as a function of the most basic soil property, primary particle distribution in the matrix soil. Data from 28 soils were analyzed to develop equations that describe sediment characteristics, including distribution of particle classes and composition of the particle classes as a function of the primary particle distribution in the matrix soil. Important sediment particle classes identified were primary clay, primary silt, and primary sand and small aggregate, and large aggregate. The equations calculate the fractions of these classes in the sediment at its point of detachment, the clay and silt fractions in the small aggregates class, and the clay, silt, and sand fractions in the large aggregate class. The equations derived for estimating the composition of the particle classes can be used, together with specific surface areas, to compute enrichment ratios for evaluating the change in contaminant concentration of sediment when deposition changes the composition of the sediment. The equations describe sediment characteristics at the point of detachment and not at the edge of fields. They are intended for use in erosion/sediment yield models, for field-sized areas, that route sediment by particle classes to compute changes in sediment characteristics caused by transport and deposition between the point of detachment and edge of field. (Baker-IVI)
W86-00493

RELATIONSHIP OF CELLULAR PHOSPHORUS IN THE CYANOBACTERIUM NODULARIA TO PHOSPHORUS AVAILABILITY IN THE PEEL-HARVEY ESTUARINE SYSTEM,
Western Australia Univ., Nederlands. Inst. of Agriculture.
For primary bibliographic entry see Field 2L.
W86-00531

TRANSFORMATIONS OF SUBSTANCES IN AQUATIC SYSTEMS AND THEIR HYGIENIC EVALUATION (STOFFTRANSFORMATIONEN IN AQUATISCHEN SYSTEMEN UND IHRE HYGIENISCHE BEWERTUNG),
Institute of General and Municipal Hygiene, Moscow (USSR).
G. N. Krassovski, A. A. Korolew, S. I. Scholdakowa, R. Koch, and H.-J. Dobberkau.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 363-368, 1984. 2 Tab.

Descriptors: *Chemical reactions, *Fate of pollutants, *Toxicity, Bioaccumulation, Water treatment, Drinking water, Carcinogens, Mutagens, Teratogens, Organic compounds, Oxidants.

Chemical substances can be transformed under the influence of physical/chemical and/or biochemical active factors. By this, the ecotoxicological and hygiene-toxicological properties and effects of the substances are changed also with respect to toxicity, late effects (carcinogenetic, mutagenic, teratogenetic ones) as well as the bio- and geo-accumulation behavior. Such transformations occur also during water treatment, and therefore also the properties and effects of the transformation products have to be taken into account for determining the limit values for pollutants in raw water for the production of drinking water. Since frequently one has incompletely known transformation products or mixtures of substances, a coefficient of hazard is suggested for the evaluation. It is the quotient of the threshold concentrations of the initial substance and of the transformation products for the different (organoleptic, toxic, carcinogenic, teratogenetic etc.) effects. For several organic substances it is demonstrated that the transformation products can be regarded less toxic compared with the initial substance. Strong oxidants, however, cause an increased danger in many cases. (Author's abstract)
W86-00538

RELATIONSHIP BETWEEN ORGANIC CARBON AND CHEMICAL OXYGEN DEMAND,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
For primary bibliographic entry see Field 2K.
W86-00540

MODEL OF A BACTERIAL CULTURE UTILIZING A TOXIC SUBSTRATE IN CONTINUOUS FLOW CONDITIONS,
Bulgarian Academy of Sciences, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika.
S. E. Teodorova, and I. K. Sivriev.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 637-643, 1984. 3 Fig, 12 Ref.

Descriptors: *Bacteria, *Toxic substances, Mathematical equations, Fate of pollutants, Biological wastewater treatment, Enzymes, Bacterial decomposition.

A model for the population growth of a bacterial culture growing by use of a single toxic substrate is presented and discussed. The model for an enzymatic reaction with one substrate, which simultaneously acts on the enzyme as an irreversible inhibitor, is: S + E (which leads irreversibly to E' with rate constant k sub 3) leads reversibly to C (k sub 1 = forward rate constant, k sub -1 = backward rate constant), which in turn leads irreversibly to P + E, with rate constant k sub 2, in which S = substrate, E = enzyme, E' = inactivated enzyme, and P = product. The equation for the stationary state has the form dc/dt = 0 = k sub 1(s-c) (e-c-e') - k sub -1(c) - k sub 3 (s(2)) - k sub 2 (c), in which the small letters are the corresponding concentrations. It is assumed that the velocity of inactivation of the enzyme is proportional to the square of the concentration of the substrate: de'/dt = k sub 3 (s(2)). To use the equation in the stationary state, it is suggested that the concentration of the inactivated enzyme is negligibly small compared to the concentration of active enzyme. The relative velocity of growth of the bacterial culture, the growth of the bacterial culture that degrades substrate S, the influence of the concentration of toxic substrate on the relative velocity of biomass synthesis may be obtained from this model. The model applies in the investigation of the stability of the biological processes employed for the degradation of different toxic substances and for the explanation of the specific mechanism of the inhibiting action of the toxic substances on the various microorganisms. The model may be used for selecting optimum conditions and parameters for biodestruction of noxious substances in water pools and purifiers. (Rochester-IVI)
W86-00549

ACID MINE DRAINAGE CONTAMINATES GROUNDWATER OF A TENNESSEE WATERSHED,
Tennessee Cooperative Fishery Research Unit, Cookeville.
C. J. O'Bara, and R. D. Estes.
Environmental Geology and Water Science, Vol. 7, No. 3, p 159-161, 1985. 2 Tab, 7 Ref.

Descriptors: *Groundwater pollution, *Acid mine drainage, *Springs, *Tennessee, Water pollution sources, Surface mines, Abandoned mines, Acidity, Hydrogen ion concentration, Sulfates, Iron, Manganese, Elevation, Hydrogeology.

Surface mining began in the West Fork of the Obey River Watershed, Tennessee, during the early 1900s and ceased in the 1950s. Water samples were collected from 18 natural springs within the West Fork of the Obey River watershed to determine if groundwater was adversely affected by runoff from abandoned surface coal mines. Six springs were found to be affected severely and deemed unfit as a source of potable water. The degraded springs were located on the Cumberland Plateau and along the western escarpment of the plateau. Generally, water of affected springs had pH less than 6.0, total alkalinity less than total acidity, and high sulfate, iron, and manganese concentrations. Water quality of the remaining springs was essentially unaffected. Three major factors were identified as possible causes in determining the quality of groundwater in the watershed. The proximity of a spring to an abandoned mine was considered important in determining the quality of the water. A second factor was the elevation at the outflow of a spring, which can be associated with different aquifers. The third factor was the geological characteristics of the strata surrounding the spring. (Moore-IVI)
W86-00555

DISTRIBUTION AND BACKGROUND OF TOTAL MERCURY IN SEDIMENTS FROM BOHAI BAY,
National Bureau of Oceanography, Hangzhau (China). Second Inst. of Oceanography.
X. Zhang, and X. Liao.
Marine Sciences, Vol. 9, No. 1, p 32-37, January, 1985. 9 Fig, 2 Tab.

Descriptors: *Mercury, *Sediments, *Bohai Bay, *China (Peoples Republic), Heavy metals, Water pollution sources, Estuaries, Bays.

One hundred twenty-one samples of the surface sediments were taken from Bohai Bay (Peoples Republic of China) in 1978-1980; their total mercury values ranged from 0.005 to 0.560 ppm, with an average value of 0.065 ppm. The higher levels (0.05 ppm) were in the west part of the Bay adjacent to the estuary of Beitang. The contents of mercury decreased rapidly with increasing distance from the estuary. The area of Bohai Bay polluted by mercury accounts for 5%. According to the data from 7 cores, the background of total mercury was confirmed to be 0.05 ppm. (Author's abstract)
W86-00579

PROCESSES OF BIOACCUMULATION: THE IMPORTANCE OF CHEMICAL SPECIATION,
Institute for Marine Environmental Research, Plymouth (England).
A. Nelson, and P. Donkin.
Marine Pollution Bulletin, Vol. 16, No. 4, p 164-169, April, 1985. 3 Fig, 45 Ref.

Descriptors: *Chemical speciation, *Marine pollution, *Bioaccumulation, Heavy metals, Organic compounds, Mercury, Lead, Bioassay, Bioavailability.

The realization of the importance of chemical speciation in marine pollution studies has brought chemists and biologists together such that not only can the chemical and geochemical behavior of a pollutant be evaluated but this can be linked to the extent of toxicological effect of the predominant species of the contaminant. This combination of chemical and biological understanding is an essential prerequisite of predictive modelling of the biological impact of pollutants. The chemical cycling of mercury in the environment is used as an example of the concept of chemical speciation. The primary barrier between an organism and its environment is the cell membrane. The toxicity of many agents is related therefore to their lipid solubility and thus to their ability to pass through the lipoprotein membrane of the cells. Since the lipid-soluble species tend to be retained in the membranes and fatty tissues of organisms, bioavailable compounds also are very often accumulated. Various carrier species in the membrane serve to facilitate the passage of molecules and ions. Also the organism/water boundary represents an interface where the surfactant properties of the transported moiety will determine to some extent its bioavailability. Experimental investigations of bioavailability are reported for heavy metals, and organic compounds. Methods used in the measurement of chemical speciation are discussed including physiochemical methods, electrochemical methods, and bioassay. (Baker-IVI)
W86-00600

EFFECT OF PH ON METHYL MERCURY PRODUCTION AND DECOMPOSITION IN LAKE SEDIMENTS,
Manitoba Univ., Winnipeg. Dept. of Microbiology
P. S. Ramlal, J. W. M. Rudd, A. Furutani, and L. Xun.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 685-692, April, 1985. 34 Ref. NRC grant 79-00312.

Descriptors: *Hydrogen ion concentration, *Methyl mercury, *Decomposition, *Lake sediments, Mercury compounds, Ontario, Interstitial water, Methylation, Demethylation, Acidification.

Mercury methylation was measured in surficial sediments taken from unacidified and experimentally acidified lakes in the Experimental Lakes Area, northwestern Ontario. A reduction in the pH of sediments lowered the rate of Hg-203 methylation. Methylation was undetectable at pH < 5.0. This decrease in mercury methylation was probably related to a shortage of available inorganic mercury when the pH of the sediment porewater was reduced. Below pH 6.0, inorganic mercury concentrations in porewater, measured with 203Hg, were reduced to less than 20% of that found at unaltered pH. A comparison of methylation and demethylation rates was made at various pH's. The rate of demethylation decreased to a lesser extent than methylation as the pH was lowered. This research indicates that enhanced mercury methylation in the sediment is not responsible for the observed increase in mercury levels in fish from acidified lakes. (Author's abstract)
W86-00605

NICKEL ACCUMULATION BY SCENEDESMUS AND DAPHNIA: FOOD-CHAIN TRANSPORT AND GEOCHEMICAL IMPLICATIONS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
C. J. Watras, J. MacFarlane, and F. M. M. Morel.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 724-730, April, 1985. 4 Fig, 2 Tab, 42 Ref.

Descriptors: *Nickel, *Bioaccumulation, *Food chains, *Geochemistry, Scenedesmus, Daphnia, Particulate matter, Algal growth, Sediments.

The accumulation of Ni in two levels of a simple aquatic food chain was determined as a function of the concentration of the free metal ion. In NTA-buffered media, Scenedesmus obliquus accumulated Ni to concentrations 30-300 times above ambient. At pNi (= -log Ni(2+) concentration) below 8, algal growth rate declined, cellular Ni quota increased, but no change in the relative size of labile and nonlabile Ni pools was detected. In the same media, Daphnia magna also concentrated Ni but only to levels slightly above ambient. Both short-term (72-h) and long-term (13-d) incubations with D. magna indicated that direct uptake from solution rather than uptake from ingested algae was the primary accumulation vector. There was no biomagnification from the algae to the zooplankton. Ingested particulate Ni was concentrated presumably in fecal matter, which normally sinks to the sediment. (Author's abstract)
W86-00607

5C. Effects Of Pollution

CALCIUM CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
May 1984. 76 p, 27 Fig, 6 Tab, 112 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Calcium chloride, *Chemical spills, *Spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Lakes, Fishkill, Environmental effects, Pollutant identification, Chemical properties, Physical properties.

Information useful for designing countermeasures for calcium chloride spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, suggested countermeasures, and analytical methods. When spilled into water, calcium chloride dissolves rapidly. Mixing in still water is by molecular diffusion; in streams, by turbulence. Nomograms are given for calculating calcium chloride concentrations in nontidal rivers and in lakes. If spilled onto soil, the potential for contamination of groundwater and surface water exists. Nomograms show how calcium chloride travels in coarse sand, silty sand, and clay till. The 4-day median lethal toxicity for aquatic life is $>$ 1000 mg per liter. Fishkills were reported at concentrations of 555 mg per liter (168 hours) to 7752 mg per liter (22 hours). Toxicity studies on fish, frogs, and microorganisms at levels of 84,000 to 22,080 mg per liter are reported. Three methods are suggested for treating water contaminated with calcium chloride: (1) add soda ash and neutralize the clear water with hydrochloric acid, (2) mixed ion exchange, and (3) reverse osmosis.
W86-00309

FERRIC CHLORIDE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
August 1984. 88 p, 22 Fig, 6 Tab, 192 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Ferric chloride, *Chemical spills, *Spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Rivers, Lakes, Fishkill, Environmental effects, Pollutant identification, Chemical properties, Physical properties.

Information useful for designing countermeasures for ferric chloride spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, previous spill experiences, suggested countermeasures, and analytical methods. When spilled into water, ferric chloride dissolves and mixes rapidly. Mixing takes place by molecular diffusion in still water and by turbulence in streams. Ferric chloride hydrolyzes in all but the most acid water to form a hydrous ferrous oxide suspension. Nomograms are given for calculating pollutant concentrations in nontidal rivers and in lakes. If spilled onto soil, the potential for contamination of groundwater and surface water exists. Nomograms show how ferric chloride travels in coarse sand, silty sand, and clay till. The 4-day median lethal toxicity for aquatic life has not been assigned. Fishkill and fish toxicity data are reported. Effects on microorganisms and invertebrates are listed. Ferric chloride does not biodegrade. It contributes to sludge volume accumulation in water treatment plants. It inhibits sludge digestion in wastewater treatment plants at 500-1000 mg per liter. Ferric chloride spills into water reduce the pH, harming aquatic life. A contaminated water body may be neutralized with a base such as sodium bicarbonate and the resulting precipitate removed by sedimentation or filtering.
W86-00310

CHLORINE: ENVIRONMENTAL AND TECHNICAL INFORMATION FOR PROBLEM SPILLS.
Environmental Protection Service, Ottawa (Ontario).
March 1984. 122 p, 31 Fig, 10 Tab, 256 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Chlorine, *Chemical spills, *Spills, *Aquatic life, *Toxicity, *Water pollution prevention, Transportation, Rivers, Lakes, Fishkill, Invertebrates, Amphibians, Aquatic animals, Degradation, Environmental effects, Pollutant identification, Chemical properties, Physical properties, Activated carbon.

Information useful for designing countermeasures for chlorine spills and for assessing their effects on the environment includes a summary of pertinent data, chemical and physical properties, production and transportation, fate in the environment, toxicity to aquatic life and other organisms, suggested countermeasures, previous spill experiences, and analytical methods. When spilled into water, liquid chlorine sinks and boils, producing gaseous and dissolved toxic materials, including hypochlorous acid and hydrochloric acid. Nomograms are given for calculating chlorine concentrations in nontidal rivers and in lakes. The 4-day median lethal toxicity rating for aquatic life is less than 1 mg per liter. Fishkills have been reported in fresh water at concentrations of 0.3-2.2 mg per liter and exposures up to 4 hr. Fish toxicity studies are also reported for concentrations of 0.07-3.0 mg per liter. Toxicity to invertebrates, zooplankton, amphibians, and microflora are listed for fresh water and salt water. Fish and other aquatic life have been killed and stressed by releases of chlorinated wastewater effluents and chlorinated powerplant cooling water. Chlorine degrades rapidly in water, forming chloride as the end product. The fate of chlorine in sea water is complex. Chlorine spilled into water may be adsorbed by activated carbon, applied at 10% of the spill amount over the region occupied by 10 mg per liter or greater level, followed by dredging. Chlorine-contaminated water may be treated by acidification with sulfuric acid

(pH 2.0-3.0) followed by reduction with sodium bisulfite.
W86-00319

COASTAL MARINE RESOURCES INVENTORY, 1983: PEMAQUID POINT TO SPRUCE HEAD,
Maine State Dept. of Marine Resources, West Boothbay Harbor. Marine Resources Lab.
D. J. Card, and R. A. Aho.
(1984). 432 p, 8 Tab, 54 Maps, 305 Ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Water pollution control, *Marine resources, *Oil spills, *Coasts, *Maine, Clams, Invertebrates, Marine animals, Beaches, Shores, Fish, Lobsters, Marinas, Harbors, Aquaculture, Industrial water, Wildlife, Boating, Pemaquid Point, Spruce Head, Maps, Shellfish.

The marine resources of the Main coast were inventoried to develop information for oil spill protection and damage assessment. In the coastal area from Pemaquid Point to Spruce Head 253 resources were identified which are susceptible to oil spill damage. These were classified into priorities. The soft-shell clam flats (1063 acres with a standing crop of over 48,000 bushels worth $3.6 million) are considered first priority. Second priority resources are lobster holding facilities, aquaculture facilities, anadromous fish streams, industrial intakes, and marinas/boat yards. Priority III is sand beaches, parks, wildlife preserves, critical areas, and natural areas. Priority IV is scenic sites, historic sites, and boat ramps. A user's guide gives directions for rapid response to an oil spill on the coast. The fate of oil in the marine environment and the biological effects of oil on various marine organisms (fish and invertebrates) are discussed.
W86-00322

ABATE: EFFECTS OF THE ORGANOPHOSPHATE INSECTICIDE ON BLUEGILLS AND INVERTEBRATES IN PONDS,
Columbia National Fisheries Research Lab., MO.
H. O. Sanders, D. F. Walsh, and R. S. Campbell.
Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981. 6 p, 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Abate, *Insecticides, *Water pollution effects, *Bluegills, Fish, *Invertebrates, Ponds, *Organophosphorus pesticides, Ecological effects, Growth, Fish physiology, Pesticides, Larvae, Biomass.

Application of the organophosphate insecticide Abate three times (at about monthly intervals) to duplicate 0.04 ha earthen ponds at 18 g/ha (4 micrograms/L) - the recommended application rate - and 180 g/ha (40 micrograms/L) caused no mortality of bluegills (Lepomis macrochirus). In ponds treated with 18 g/ha fewer bluegill fry were produced than in control ponds, brain acetylcholinesterase (AChE) activity was not affected, and accelerated growth of both fry and adults appeared to result from heavy feeding on dead or moribund Diptera larvae that resulted from each of the first two applications of Abate. In ponds treated with 180 g/ha ovary development in bluegills was initially faster than in bluegills from control ponds, the number of fry produced per female was lower than in control ponds (but growth of fry was unaffected), brain AChE activity in bluegills was strongly inhibited after the second and third treatments, and biomass of Diptera in the ponds was reduced about 40% but other invertebrates were unaffected. The routine use of Abate at the recommended rate should have little adverse effect on fishery resources. (Author's abstract)
W86-00341

SOURCES, CHEMISTRY, FATE, AND EFFECTS OF CHROMIUM IN AQUATIC ENVIRONMENTS.
Ecological Analysts, Inc., Sparks, MD.
For primary bibliographic entry see Field 5B.
W86-00344

EFFECTS OF OIL ON AQUATIC ORGANISMS: A REVIEW OF SELECTED LITERATURE,
Oklahoma State Univ., Stillwater. Water Quality Research Lab.
S. L. Burks.
American Petroleum Inst., Washington, DC. 69 p, 6 Tab, 195 Ref.

Descriptors: *Oil spills, *Reviews, *Water pollution effects, *Oil pollution, *Ecosystems, *Hydrocarbons, *Aquatic animals, *Aquatic plants, Aquatic environment, Oil, Oily water, Algae, Diatoms, Petroleum products.

Spills of light refined oil on aquatic ecosystems will probably cause extensive mortality of sessile species, but mobile species may not be affected unless confined by physical barriers. Most investigations indicate that both freshwater and marine communities are capable of recovering from an oil spill incident within a year. Measured concentrations of petrogenic hydrocarbons in the water column have been reported to range from nondetectable to 60 micrograms/liter. Chemical dispersants may temporarily increase levels of hydrocarbons in the water column, up to 200 micrograms/liter. Low molecular weight aromatic hydrocarbons dissipate rapidly while compounds with low aqueous solubility persist longer after an oil spill. The toxic properties of crude oils appear to be related to the percentage concentration of aromatic hydrocarbons, molecular weight, and aqueous solubility. Except for the 4- and 5-ring polynuclear aromatic hydrocarbons, the relatively lethal effects to marine fish and invertebrates appear to increase from mono-aromatics to alkylated aromatics to dinuclear aromatics. Larvae of fish and most crustaceans appear to be very susceptible to the water soluble fraction of crude oils. Growth of some species of polychaete worms appears to be tolerant. The greatest potential threat to aquatic ecosystems may be the continuous long-term contamination with petroleum hydrocarbons in surface water runoff from urban areas and in wastewater from municipalities in industrial areas.
W86-00349

HAZARDOUS MATERIALS SPILLS-MANAGEMENT REVIEW,
Texas Transportation Inst., College Station.
For primary bibliographic entry see Field 10D.
W86-00350

IMPACT OF XENOBIOTIC CHEMICALS ON MICROBIAL ECOSYSTEMS.
Fish and Wildlife Service, Washington, DC.
Technical Papers, No. 107, 1982. 36 p. Edited by B. Thomas Johnson.

Descriptors: *Water pollution effects, *Ecosystems, *Microorganisms, *Paraquat, *Aquatic populations, *Xenobiotics, *Detritus, *Organic compounds, Ecological effects, Aquatic environment, Environmental impact statement, Pesticides, Herbicides, Microenvironment, Microbiological studies, Industrial wastes, Environmental effects.

These technical papers were presented at the Annual Meeting of the American Society for Microbiology held in Miami Beach Florida in May of 1980. The estimated 70,000 chemical compounds synthesized annually in the United States include such diverse xenobiotics as cyclic intermediates, dyes, organic pigments, medicinal chemicals, flavor and perfume materials, plastic and resin materials, rubber processing chemicals, elastomers, plasticizers, surface-active agents, and pesticides and related products. The question of the hazards of xenobiotics to microbial ecosystems was raised to meeting participants. In response, reports were presented on the potential role of microbial effects testing (environmental risk assessment), the effects of pesticides on non-target microorganisms in agricultural soil, a scheme for microbial toxicity testing of synthetic organic chemicals, and examples of xenobiotic poisoning of specific and non-specific microbial pathways. A method for biochemical determination of biomass and community structure of estuarine detrital and sedimentary microbiota was outlined for use in assessing the effects of xenobiotics. A paper dealing with the cellular mechanisms of paraquat toxicity was also presented.
W86-00352

ENVIRONMENTAL RISK ASSESSMENT: THE POTENTIAL ROLE OF MICROBIAL EFFECTS TESTING,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
J. D. Walker.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 3-5. 1 Tab, 20 Ref.

Descriptors: *Microorganisms, *Microbiological studies, *Aquatic environments, *Growth, *Metabolism, *Water pollution effects, *Bioindicators, *Microbial degradation, Ecological effects, Bacteria, Laboratory tests, Testing procedures, Oxidation-reduction potential, Ecosystems.

Environmental microbiology testing involves assessing the effect of microorganisms and microbial processes on chemical substances and determining the effect of chemical substances on microorganisms and microbial processes. Microbial effects testing may provide a sensitive method for detecting potential environmental perturbations. The use of microbial effects tests might have alerted the Life Sciences Corporation to the problems that resulted from releasing what was probably Kepone, into the Hopewell, Virginia biological treatment plant. Microbial effects tests for measuring decomposition of organic substances have provided sensitive and rapid methods for detecting the effects of smelter emissions on microbial processes in soils. Some representative microbial effects tests provide measurements of growth, product formation, and substrate oxidation, reduction or disappearance. Microbial effects tests may provide sensitive, reproducible, and cost-effective methods for detecting the effects of toxic substances on microorganisms and their activities.
W86-00353

MICROBIAL TOXICITY TESTING OF SYNTHETIC ORGANIC CHEMICALS,
Monsanto Co., St. Louis, MO.
W. E. Gledhill.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 11-14. 2 Tab, 9 Ref.

Descriptors: *Testing procedures, *Water pollution effects, *Microorganisms, *Ecosystems, *Environmental effects, *Ecological effects, *Microbiological studies, Toxins, Water quality standards, Regulations, Environmental protection, Fate of pollutants, Organic compounds.

Federal regulations such as the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act mandate the testing of new chemicals for their toxicity to numerous biological species, including microorganisms. In general microorganisms are less sensitive to xenobiotics than are higher species due to their greater adaptive capabilities, cell wall structure, enzymes and protection afforded by the environment. It was suggested, therefore, that higher organisms be used in initial environmental effects testing and the testing of toxicity to microorganisms be conducted based on initial screening results. A modified TSCA environmental screening program should examine the fate of xenobiotics (mobility and persistence) and the aquatic toxicity to algae, invertebrates and fish. Water quality regulations arising from tests on higher organisms should be sufficiently restrictive to protect microbial populations. At present, there is no consensus as to the best methodology for determination of apppropriate microbial toxicological information. More research is needed in establishing laboratory microcosms to simulate more closely the microbiological processes in the natural environment.
W86-00354

BIOCHEMICAL DETERMINATION OF BIOMASS AND COMMUNITY STRUCTURE OF ESTUARINE DETRITAL AND SEDIMENTARY MICROBIOTA,
Florida State Univ., Tallahassee. Dept. of Biological Science.

D. C. White.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 22-28. 2 Fig, 4 Tab, 34 Ref.

Descriptors: *Biomass, *Marine sediments, *Microorganisms, *Ecosystems, *Testing procedures, *Lipids, *Water pollution effects, *Biochemistry, Ecological effects, Oil pollution, Environmental protection, Metabolism, Estuarine environment, Bioindicators.

Sedimentary microbial biomass, metabolic activity, nutritional status, and community structure were determined by the analysis of extractable lipids and hydrolysis products of the lipid extracted residue in microbial communities in the laboratory or in the field. These methods have been validated by analysis of mixtures of microbial monocultures isolated from microbial assemblies, by measurements of the effects of grazing by selective deposit feeding invertebrates, and by scanning electron microscopic analysis of detrital microbial assemblies manipulated with antibiotics, nutrients, and light. Such methods have shown that milligrams/liter concentrations of xenobiotics in fluids used in oil and gas well drilling can significantly modify the biomass and community structure of microbial assemblies colonizing marine sand. These techniques can also allow estimation of the validity of using microcosm test systems to determine the impacts of xenobiotics in the field. These methods could greatly strengthen the legal applicability of data used by regulatory agencies in protecting estuarine environments.
W86-00355

CELLULAR MECHANISMS OF PARAQUAT TOXICITY,
Columbia National Fisheries Research Lab., MO.
M. Heitkamp, and O. R. Brown.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 107, 1982, p 29-36. 4 Fig, 5 Tab, 40 Ref.

Descriptors: *Paraquat, *Escherichia coli, *Growth, *Rodents, *Defoliants, *Water pollution effects, *Lethal limit, *Pesticide toxicity, Herbicides, Bacteria, Microorganisms, Pesticides, Toxins, Amino acids, Agricultural chemicals, Fish, Mammals, Mortality, Toxicity.

Paraquat (1,1'-dimethyl-4,4'-bipyridylium ion), a non-selective contact defoliant and herbicide is toxic to various organisms, including man. Oxygen radicals are reportedly generated in tissues by paraquat; thus there is a potential link between the mechanisms of poisoning by paraquat and hyperbaric oxygen. A study was undertaken of specific sites of paraquat toxicity, using bacteria and rats. Specific amino acids and niacin partly protected Escherichia coli from the bacteriostatic effects of 1mM paraquat. The amino acids appeared to protect the bacteria because aerobic paraquat poisons the same pathways of amino acid biosynthese previously found to be sensitive to hyperbaric oxygen. Specifically, dihydroxyacid dehydratase, which is required for branch-chain amino acid biosynthesis, was poisoned in cells exposed to paraquat. Niacin further protected E. coli against growth inhibition and specifically against the decrease in nicotinic acid adenine dinucleotide (NAD) that otherwise occurred. NAD was decreased because paraquat apparently poisoned the same enzyme (quinolinate phosphoribosyl transferase) that was previously reported to be poisoned by hyperbaric oxygen. Niacin gave significant protection to rats injected with lethal amounts of paraquat; the time to LT50 was increased from 60 to 115 h, and the percentage of animals surviving for 1 week was increased from 20 to 45 in a study with four groups of 25 animals each. (Author's abstract)
W86-00356

CHEMICAL CONTAMINANTS AND ABNORMALITIES IN FISH AND INVERTEBRATES FROM PUGET SOUND,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. C. Malins, B. B. McCain, D. W. Brown, A. K. Sparks, and H. O. Hodgins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-11518 8. NOAA Technical Memorandum OMPA-19, June 1982. 168 p. 44 Fig, 42 Tab, 108 Ref, Append.

Descriptors: *Invertebrates, *Water pollution effects, *Fish, *Hydrocarbons, Polychlorinated biphenyls, Water pollution effects, Pollutants, *Puget Sound, Liver, Metals, Lead, Arsenic, Mercury, Sediments, Urban areas, Rural areas, Washington.

Samples of sediment and selected bottom-dwelling fish and invertebrates were collected at regular intervals from 1978 to the spring of 1981 from urban and rural areas of Puget Sound. The concentrations of aromatic hydrocarbons (AH), polychlorinated biphenyls (PCB) and chlorinated butadienes were widely distributed in sediment from Puget Sound with the highest concentrations in Commencement Bay and Elliott Bay. Arsenic and mercury were only detected in sediment from urban areas, whereas lead was high in both urban (130,000 ppb, dry weight) and rural (15,000 ppb, dry weight) sediments. All of the above chemicals were detected in higher concentrations in biota from urban areas. Bottom fish, crabs, and shrimp had a variety of pathological conditions. In English sole, the fish species most widely distributed throughout Puget Sound, liver neoplasms, preneoplastic and necrotic liver lesions were correlated with sediments having high concentrations of metals and AH.
W86-00358

EFFECTS OF TOXICANTS ON PLANKTON,
Environmental Research Lab., Gulf Breeze, FL.
G. E. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117044. Report EPA-600/D-82-338, 1982. 67 p. 216 Ref.

Descriptors: *Industrial wastes, *Toxic wastes, *Municipal wastes, *Plankton, Algae, Heavy metals, Pesticides, Toxicity, Pollutants, Pollution effects, Growth inhibition, Oil pollution, Zooplankton, Larvae, Eggs, Crustaceans, Sediments, Dredging.

The effects of heavy metals, pesticides, and industrial and municipal wastes on holo- and meroplankton in the field and laboratory are reviewed. Th most commonly measured response of unialgal cultures to pollutants is growth inhibition. Reports in recent years have included descriptions of the effects of pollutants on morphology, physiology and population interactions. Algae are more sensitive to industrial and municipal wastes, but more resistant to single pollutants, than animals.
W86-00360

CHLORINATED HYDROCARBONS AS A FACTOR IN THE REPRODUCTION AND SURVIVAL OF LAKE TROUT (SALVELINUS NAMAYCUSH) IN LAKE MICHIGAN,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
Technical Papers of the U.S. Fish and Wildlife Service, No. 105, 1981. 6 p, 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Lake Michigan, *Water pollution effects, *Trout, Lakes, *DDE, *Halogenated pesticides, *Pesticide toxicity, *Polychlorinated biphenyls, *Aroclors, Pesticides, Fish eggs, Hatching, Incubation, Growth, Metabolism, Fish populations, DDT, Ecological effects, Fish behavior, Hydrocarbons, Larvae, Michigan.

Although lake trout (Salvelinus namaycush) were considered extinct in Lake Michigan by the mid 1950's, control of the parasitic sea lamprey (Petromyzon marinus) and extensive restocking resulted in an abundance of hatchery-produced lake trout by the early 1970's. However, no naturally produced yearling or older lake trout have been found in the lake in nearly a decade of sampling. It was hypothesized that DDT and its metabolites and polychlorinated biphenyls (PCB's) in lake waters may adversely affect the hatchability and survival of larval fish. However, manually stripped and fertilized trout eggs have hatched successfully and the fry have survived normally under a variety of hatchery conditions. A series of studies were conducted at the Great Lakes Fishery Laboratory on the effects of chlorinated hydrocarbons on the reproduction and survival of Lake Trout in Lake Michigan. Specific investigations examined the comparative hatchability of lake trout eggs under different conditions of contaminant burden and incubation, and the effects of chronic exposure to PCB's and DDE on growth and mortality of fry, swimming performance of young lake trout, vulnerability of young lake trout to predation, and temperature selection by young lake trout. Laboratory and field studies on the effects of contaminants on the biochemistry and metabolism of lake trout were also conducted.
W86-00363

INTRODUCTION AND SUMMARY,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
W. A. Wilford, R. A. Bergstedt, W. H. Berlin, N. R. Foster, and R. J. Hesselberg.
In: Technical paper of the U.S. Fish and Wildlife Service, No. 104, 1981, p 1-7. 24 Ref.

Descriptors: *Lake Michigan, *Water pollution effects, *Trout, *Pesticides, *DDE, *Pesticide toxicity, *Polychlorinated biphenyls, *Aroclors, Growth, Metabolism, Fish eggs, Fish populations, Hydrocarbons, Halogenated pesticides, Ecological effects, Fish behavior, Michigan.

Studies were performed at the Great Lakes Fishery Laboratory on the performance and survival of fry hatched from eggs of Lake Michigan lake trout and exposed for 6 months to PCB's (Aroclor 1254) and DDE at concentrations similar to those present in offshore waters and zooplankton of Lake Michigan (10.0 nanograms/liter PCB's and 1.0 nanograms/liter DDE in water; 1.0 micrograms/g PCB's and 0.1 micrograms/g DDE in food), and at concentrations 5 and 25 times higher. Cumulated mortality of the exposed fry was nearly twice that of unexposed controls. Evaluations of the growth, swimming performance, predator avoidance behavior, temperature preference, and metabolism of the fry showed no significant effects attributable to exposure to PCB's and DDE, except for a lowering of preferred temperature at the highest exposure level for each contaminant and additively when both contaminants were combined. Although several factors undoubtedly contributed to the lack of recruitment of naturally produced lake trout in Lake Michigan, the levels of PCB's and DDE present during the early to mid 1970's were sufficient to significantly reduce survival of any fry produced in the lake and thereby impede restoration of the lake trout population to self-sustainability.
W86-00364

COMPARATIVE HATCHABILITY OF LAKE TROUT EGGS DIFFERING IN CONTAMINANT BURDEN AND INCUBATION CONDITIONS,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac, W. H. Berlin, and D. V. Rottiers.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 8-10. 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Lake Michigan, *Water pollution effects, *Hatching, *Trout, *Fish eggs, *Polychlorinated biphenyls, *DDE, *Pesticides, *Aroclors, Larvae, Hydrocarbons, Chlorinated hydrocarbons, Halogenated pesticides, Ecological effects, Mortality, Lakes, Michigan.

In 1972, fertilized eggs of lake trout (Salvelinus namaycush) from the Marquette (Michigan) State Fish Hatchery (where levels of contaminants are relatively low) and eggs from lake trout collected in Michigan waters of Lake Michigan near Saugatuck and Charlevoix (where levels of PCB's and DDE are elevated) were incubated at hatchery temperatures (6 degrees) and at temperatures simulating the natural temperature cycle of Lake Michigan (1-8 degrees). Survival to yolk absorption of larvae from these three sources ranged from

40.3 to 65.5%, and no correlation was observed between survival and the level of PCB's and DDE in the eggs. Additional studies in 1975 with lake trout eggs from the same three sources confirmed previous observations that the elevated levels of PCB's and DDE in eggs from Lake Michigan did not appear to affect the percent hatch of lake trout eggs or survival of the fry to the swim-up stage. When fry hatched from eggs with an elevated contaminant burden were starved for several weeks, no abnormal increase in posthatching mortality during the period when the yolk stores were being consumed was observed. (Author's abstract)
W86-00365

GROWTH AND MORTALITY OF FRY OF LAKE MICHIGAN LAKE TROUT DURING CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
W. H. Berlin, R. J. Hesselberg, and M. J. Mac.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 11-22. 2 Fig, 8 Tab, 37 Ref.

Descriptors: *Water pollution effects, *Polychlorinated biphenyls, *DDE, *Pesticides, *Growth, *Trout, *Mortality, *Bioaccumulation, Aroclors, Hydrocarbons, Halogenated pesticides, Lakes, *Lake Michigan, Fish, Michigan.

Fry hatched from eggs of Lake Michigan lake trout were chronically exposed to concentrations of PCB's and DDE similar to those found in water and plankton in southeastern Lake Michigan (LX) and to concentrations 5 (5X) and 25 (25X) times greater. Body levels of contaminants in fry decreased at 1X level of PCB's and at 1X and 5X levels of DDE, but generally increased at all other contaminant exposure levels. PCB and DDE uptake was evident from increased body burdens of the contaminants at all exposure levels and in the controls. Growth was not significantly affected by any of the contaminant exposure levels. Mortalities of fry exposed to the 1X and 5X contaminant levels were significantly less than those of control fry before day 56. Between days 57 and 136, mortality rates increased rapidly and were significantly higher in all exposed groups than in the control group. Although mortality was lower in the last 40 days of exposure, it continued to be significantly higher in all exposed fry than in controls, except those in the 1X and 5X PCB groups. By the end of the 176-day study, the total cumulative mortality ranged from 30.5 to 46.5% in the exposed groups and was 21.7% in the control group.
W86-00366

SWIMMING PERFORMANCE OF YOUNG LAKE TROUT AFTER CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. V. Rottiers, and R. A. Bergstedt.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 23-28. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Fish behavior, *Water pollution effects, *Polychlorinated biphenyls, *Pesticides, *DDE, *Aroclors, *Trout, *Halogenated pesticides, *Ecological effects, Lakes, *Lake Michigan, Hydrocarbons, Fish populations, Michigan.

Swimming performance was measured in fry of lake trout hatched from Lake Michigan fish. The fry were exposed for 50, 110, and 165 days to PCB's, DDE, and a combination of these two contaminants in both food and water at concentrations equal to, and 5 and 25 times higher than levels found in Lake Michigan water and plankton. Swimming performance was assessed by forcing the fry to swim through a continuous series of incrementally increased velocities until the fish were exhausted. Although significant differences in swimming performance were observed between a few test groups, no relation between swimming performance of the fry and exposure to PCB's or DDE, or both was noted at the concentrations tested. Inasmuch as swimming performance apparently was not affected by the levels of contamination by PCB's and DDE in Lake Michigan, impairment of swimming by these contaminants cannot account for the failure of lake trout reproduction in Lake Michigan.
W86-00367

VULNERABILITY OF YOUNG LAKE TROUT TO PREDATION AFTER CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 29-32. 3 Tab, 10 Ref.

Descriptors: *Fish populations, *Trout, *Lake Michigan, *DDE, Polychlorinated biphenyls, *Predation, *Fish behavior, *Water pollution effects, Lakes, Pesticides, Aroclors, Ecological effects.

The vulnerability of fry of Lake Michigan lake trout (Salvelinus namaycush) to predation by rainbow trout (Salmo gairdneri) was tested after the fry had been exposed to PCB's, DDE, and a combination of these contaminants in both water and food at concentrations corresponding to ambient levels (1X) in water and plankton in Lake Michigan and at levels 5 and 25 times higher. Vulnerability of the fry, measured as the ratio of escapes to predator attacks, was not significantly increased by either 90 or 165 days of exposure to the contaminants at any of the concentrations tested, and no behavioral differences were observed between control and exposed fry in their reaction to predators. Exposure to PCB's and DDE at environmental and higher concentrations thus did not affect the vulnerability of lake trout fry to predation. This observation suggests that the failure of lake trout reproduction in Lake Michigan was not caused by contaminant-induced reductions in the ability of the fry to escape predators. (Author's abstract)
W86-00368

TEMPERATURE SELECTION BY YOUNG LAKE TROUT AFTER CHRONIC EXPOSURE TO PCB'S AND DDE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
M. J. Mac, and R. A. Bergstedt.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 33-35, 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Water pollution effects, *Polychlorinated biphenyls, *DDE, *Water temperature, *Pesticides, *Fish behavior, *Trout, *Ecological effects, *Lake Michigan, Survival, Lakes, Fish populations, Halogenated pesticides, Aroclors, Michigan.

Temperature selection tests were conducted with fry of Lake Michigan lake trout (Salvelinus namaycush) exposed to PCB's, DDE and a combination of these contaminants in food and water at levels 25 times the ambient levels in plankton and water in Lake Michigan. Fry were placed in a vertical temperature gradient tank which was checked for dissolved oxygen concentration along the gradient to exclude the possibility of gas bubble disease. The tank was also checked for the possibility of N2 supersaturation by confining yearling yellow perch in the warmest surface layers for 1 wk, but no signs of gas bubble disease were detected. Results showed that exposure of fry to PCB's and DDE lowered their preferred temperature. After 98 days of exposure, mean preferred temperatures were 10.3 degrees for fry exposed to PCB's 9.8 degrees for fry exposed to DDE, and 8.7 degrees for those exposed to PCB's plus DDE, as compared with 11.2 degrees for control fry. Frequency distributions of residence temperatures were significantly different among all treatments. Such a change in the preferred temperature caused by a contaminant could reduce the energetic efficiency of a fish and thereby reduce growth and survival.
W86-00369

BIOCHEMISTRY AND METABOLISM OF LAKE TROUT: LABORATORY AND FIELD STUDIES ON THE EFFECTS OF CONTAMINANTS,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
D. R. M. Passino.
In: Technical Papers of the U.S. Fish and Wildlife Service, No. 104, 1981, p 36-42. 4 Tab, 39 Ref.

Descriptors: *Lake Michigan, *Trout, *Water pollution effects, *Enzymes, *Pesticides, *DDE, *DDT, *Polychlorinated biphenyls, *Metabolism, Ecological effects, Fish, Fish behavior, Aroclors, Halogenated pesticides, Michigan.

Several biochemical indicators of stress were measured in fry of Lake Michigan lake trout exposed to PCB's (Aroclor 1254) and DDE in food and water and in unexposed fry. No difference in treatments were observed in oxygen consumption rates of lactate concentrations of unexercised fry, but apparent differences in specific swimming speed and lactate response in fry that swam to exhaustion suggested that exposed fry had lower stamina. Observed differences between biochemical profiles of 1-day-old sac fry reared from eggs of lake trout collected off Saugatuck and those originating from eggs of brood stock at the Marquette (Michigan) hatchery may have been caused by organochlorine contamination or by genetic and dietary differences between parental stocks. Activity of allantoinase was measured in juvenile and adult trout as an indicator of sublethal effects of Great Lakes contaminants. The 50% inhibition of allantoinase in vitro occurred at 6.0 mg/liter Cu(++), 6.7 mg/liter Cd(++), 34 mg/liter Hg(++), and 52 mg/liter Pb(++). In vivo exposure to PCB which cause accumulations of 2.6 micrograms/g (whole fish) activated allantoinase slightly to the 10% significance level. Allantoinase activity was negatively correlated with total length for fish from Lake Michigan but not for fish from Lake Superior or from laboratory stocks. Hg, PCB's and DDT, acting in combination or with other contaminants may be the cause of the negative correlation of allantoinase activity with size in Lake Michigan lake trout.
W86-00370

EFFECT OF CADMIUM AND ZINC ON INTESTINAL ABSORPTION OF XYLOSE AND TRYPTOPHAN IN THE FRESH WATER TELEOST FISH, HETEROPNEUSTES FOSSILIS,
D.A.V. Coll., Muzaffarnager (India). Dept. of Zoology.
K. V. Sastry, and S. Subhadra.
Chemosphere, Vol. 13, No. 8, p 889-898, 1984. 4 Tab, 24 Ref.

Descriptors: *Fish, *Xylose, *Tryptophan, *Cadmium, *Zinc, Toxicity, Heavy metals, Nutrients, Water pollution effects.

Two experimental conditions were used to study the effect of cadmium and of zinc on the rate of uptake of a pentose sugar xylose and an aminoacid tryptophan by the intestine of a teleost fish, Heteropneustes fossilis. In the first experimental condition four concentrations of cadmium or zinc (1.0, 0.1, 0.01 or 0.001 mM) mixed with the nutrient solution were placed in the intestinal sacs and the rate of absorption was recorded after 1 hr at 23 C. In the second experiment the fish were exposed by bath to a sublethal concentration of cadmium (0.26 mg/l) or zinc (4 mg/l) for 15 min and 30 days and the rate of absorption of the two nutrients measured. The presence of cadmium or zinc in the intestine or in the ambient water can decrease the rate of transport of xylose and tryptophan and the activity of intestinal brush border Na(+), K(+) ATPase. The rate of absorption of each of the two nutrients is inversely related to the concentration of each of the two heavy metals in the instilled solution and to the period of exposure of test fish to the heavy metals. Higher concentrations of both the heavy metals decreased nutrient absorption rates to a greater extent than do lower concentrations in vitro. The decreases were most marked between 0.01 and 0.001 mM of cadmium or zinc. Thirty days exposure to each heavy metal in vivo

produced a greater decrease in the rate of absorption of the two nutrients than did exposure for 15 days. Heavy metals may also bind to the proteins of the brush border membrane of the mucosal cell and thus alter their permeability. (Baker-IVI)
W86-00390

OCCURRENCE OF R-PLASMIDS IN ESCHERICHIA COLI AND COLIFORM GERMS FROM WATER AND WASTEWATER; PART 2: METHODS OF ISOLATION OF R+ -BACTERIA FROM SURFACE AND WASTEWATER, THE TRANSFER OF THEIR R-PLASMIDS AS WELL AS THE DETERMINATION OF THE RESISTANCE IMAGES (UBER DAS VORKOMMEN VON R-PLASMIDEN IN ESCHERICHIA COLI UND KOLIFORMEN KEIMEN AUS WASSER UND ABWASSER; TEIL 2: METHODEN DER ISOLIERUNG VON R+ - BACTERIEN AUS OBERFLACHEN - UND ABWASSER, DES TRANSFERS IHRER R-PLASMIDE SOWIE DIE BESTIMMUNG DER RESISTENZ-BILDER),
Institut fur Experimentelle Epidemiologie, Wernigerode.
For primary bibliographic entry see Field 5D.
W86-00398

'MAN AND BIOSPHERE' - STUDIES ON SIKKIM HIMALAYAS. PART 2: ACUTE TOXICITY OF MIXED COPPER-ZINC SOLUTIONS ON COMMON CARP, CYPRINUS CARPIO (LINN.),
Delhi Univ. (India). Dept. of Anthropology.
B. S. Khangarot, A. Sehgal, and M. K. Bhasin.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 131-145, 1984. 3 Tab, 17 Ref.

Descriptors: *Copper, *Zinc, *Toxicity, *Carp, Fish, Water pollution effects, Heavy metals, Synergism.

A study was made of the effects of Cu-Zn mixtures to determine whether the acute toxicities of Cu and Zn are synergistic or antagonistic in the common carp, Cyprinus carpio. In batch experiments for 6 to 48 hr, individuals of C. carpio were exposed to mixed solutions of copper and zinc sulfate: pH = 6.3, temperature 15 C, 6.8 mg/l oxygen, 7.1 mg/l Ca(2+), 0.7 mg/l Mg(2+). The LC50 for the individual substances on exposures of 24 and 48 hr amounted to 9.04 and 7.28 mg/l for zinc and 0.11 and 0.095 mg/l for copper. The sum of the biological activity of the two kinds of metal ions is assessed according to Marking's index: at low concentrations of the mixed solutions the two metals show an additive effect, at higher concentrations a synergistic effect occurs. (Baker-IVI)
W86-00404

TOXICITY OF THE HERBICIDE 2,4-D-NA TO TWO SPECIES OF FRESHWATER PRAWN OF THE GENUS MACROBRACHIUM,
Gorakhpur Univ. (India). Dept. of Zoology.
Omkar, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 285-289, 1984. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Toxicity, *Herbicides, *Prawn, *Dichlorophenoxy acetic acid, Organic compounds, Pesticide toxicity, Water pollution effects.

The herbicide 2,4-D-Na (the sodium salt of 2,4-dichlorophenoxy acetic acid) is commonly used in eastern Uttar Pradesh (India); as a consequence of its use, the herbicide ultimately finds its way to the aquatic environment through runoff water and affects aquatic life. In batch experiments with exposure for 24 to 96 hr Macrobrachium naso and M. dayanum were exposed to solutions of 2,4-D-Na. The LC50,96 hr are 2.397 g/l for M. naso and 2.275 g/l for M. dayanum. No mortality was observed in solutions of 2.1 and 1.85 g/l. The differences in toxicity are not dependent on the size of the organisms, but they are species-specific. The toxicity reactiions to 2,4-D-Na were seen earlier in M. dayanum than M. naso even at the same concentrations. The specimens became excited, showed erratic swimming and attempted to jump out of the test container. Violence was seen next, followed by paralysis and death. (Baker-IVI)
W86-00413

EFFECT OF ALDRIN ON THE CARBOHYDRATE METABOLISM OF A FRESHWATER PRAWN MACROBRACHIUM LAMARREI (H.-M. EDWARDS) CRUSTACEA, DECAPODA,
Gorakhpur Univ. (India). Dept. of Zoology.
Omkar, R. Murti, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 549-552, 1984. 1 Tab, 19 Ref.

Descriptors: *Pesticides, *Toxicity, *Prawn, *Aldrin, Water pollution effects, Organic compounds, Aldrin, Metabolism, Pesticide toxicity.

The acute toxicity of aldrin to freshwater prawn was studied with particular attention to biochemical and physiological changes induced by aldrin. Aldrin had a marked effect on hepatic glycogen of Macrobrachium lamarrei. The decrease in the glycogen content was observed in all the three concentrations after each exposure which showed a time- and dose-dependent relation. The decrease in hepatic glycogen was more significant in the lowest concentration after 48 and 72 hr and highly significant in two higher concentrations up to 72 hr and in all the three concentrations after 96 hr of exposure. The blood glucose level was decreased significantly in 0.017 and 0.021 mg/l aldrin after 24 hr. The decrease in blood glucose increased with an increase in the concentration of aldrin. A rise in the glucose level was observed after 48 and 72 hr of exposure, which was more significant in two higher concentrations after 48 hr and in the lowest concentration after 72 hr exposure. The decrease in the blood glucose level after 96 hr exposure was significant at $P<0.05$, $P<0.01$, and $P<0.001$ in solutions of 0.008, 0.017, and 0.021 mg/l, respectively. The depletion in blood glucose within 24 hr of aldrin exposure indicates that the blood glucose has been used to meet the energy requirement due to the stress. (Baker-IVI)
W86-00421

'MAN AND BIOSPHERE' - STUDIES ON THE SIKKIM HIMALAYAS. PART 3: ACUTE TOXICITY OF MIXTURES OF ENDRIN AND CALAXIN ON THE TADPOLE LARVAE OF THE FROG RANA HEXADACTYLA,
Delhi Univ. (India). Dept. of Anthropology.
B. S. Khangarot, A. Sehgal, and M. K. Bhasin.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 563-565, 1984. 2 Tab, 12 Ref.

Descriptors: *Water pollution effects, *Toxicity, *Frogs, Endrin, Calaxin, Pesticides, Organic compounds, Tadpoles, Immature growth stages, Synergism.

The knowledge of the toxicity of mixtures is important, because interactions may increase or decrease the toxicity depending upon the properties of the pollutants. Further, a toxicant never occurs singly in polluted waters but is always found in mixtures. The acute toxicities of mixtures of endrin and calaxin on tadpoles of the frog Rana hexadactyla for 48 hr exposures were investigated. The LC50s and 95% confidence limits of individual insecticides at 48 hr exposures indicate that calaxin was more toxic than endrin. The sum of the biological activity of the two toxicants is 1.235, the toxicity is less than additive. A combination of endrin and calaxin (1:1) produced an additive index of -0.235, which suggests a less than additive toxicity. The 2:1 and 1:2 ratios (endrin:calaxin) were synergistic. (Baker-IVI)
W86-00422

SENSITIVITY OF SOUTHERN QUEBEC LAKES TO ACIDIC PRECIPITATION,
Quebec Univ., Sainte-Foy.
M. Lachance, B. Bobee, and Y. Grimard.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 115-132, June, 1985. 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Acid rain, *Quebec, *Lakes, Water pollution effects, Physicochemical properties, Acidity, Sulfates, Lithology, Seasonal variation, Spatial distribution, Mineralization, Canadian Shield.

Physico-chemical data from 258 Quebec lakes collected during spring and summer 1980 are examined in order to obtain a first general diagnosis of lake acidification in Quebec. The spatial variation of the mineralization of lakes is interpreted in relation to lithology and glacial deposits, allowing the identification of Canadian Shield areas particularly threatened by acid precipitation. Quebec lakes may be classified into two groups with high or low sensitivity to acidification, according to their location on either the Canadian Shield or in the Appalachian area. The study of the spatial distributions of conductivity and alkalinity values has allowed the identification of Shield areas particularly sensitive to acid precipitation. The southwest to north-east gradient in the concentration of sulfate indicates the importance of long range atmospheric transport of S and suggests that sulfate levels have substantially increased in southern Quebec lakes. The frequency distribution of pH values and the existence of a relation between pH and sulfate concentrations suggest that many lakes on the southern part of the Shield are probably affected by acid precipitation. Data obtained in the spring from some Shield lakes show a substantial decrease in pH and alkalinity during this period, compared to summer values, and demonstrate the importance of these atmospheric episodic inputs to sensitive lakes. (Baker-IVI)
W86-00427

RESPONSE OF CLIMBING PERCH, ANABAS TESTUDINEUS TO INDUSTRIAL POLLUTANTS: HEAD KIDNEY PEROXIDASE, IODIDE PEROXIDASE, AND BLOOD THYROXINE PROFILES,
Visva-Bharati Univ., Santiniketan (India). Environmental Toxicology Lab.
S. Chatterjee, and S. Bhattacharya.
Water, Air, and Soil Pollution, Vol.25, No.2, p 161-174, June, 1985. 7 Fig, 5 Tab, 29 Ref.

Descriptors: *Water pollution effects, *Fish, *Peroxidase, Phenols, Industrial wastes, Mercuric chloride, Cadmium chloride, Ammonia, Climbing perch, Perch.

Climbing perch, Anabas testudineus, were exposed under static conditions to nonlethal concentrations of HgCl2 (0.166 ppm as HgCl2), CdCl2 (166.66 ppm as CdCl2), phenol (21.11 ppm as phenol) and NH3 (54 ppm as NH3) for 2 days and then transferred to toxicant free water for 30 days. Fish were also treated chronically for 30 days with a mixture of these toxicants containing 0.083 ppm HgCl2, 66.66 ppm CdCl2, 6.66 ppm phenol and 27 ppm NH3. A chronic test for 30 days was also conducted with a factory effluent collected from the Durgapur Industrial Complex. A distinct inhibitory role of phenol, NH3, Cd, and Hg mixture of the toxicants and factory effluent was established. Not only is the enzyme inhibited during the 48 hr exposure tests but also the decrement continues long after transfer of fish to toxicant free water. Inhibition of peroxidases may result in the dysfunction of the enzymes concerned with peroxide metabolism and changes in the lipid peroxidation pathways. Peroxidase activity from head kidney was estimated in fish treated with certain individual toxicants, mixture of toxicants and a factory effluent, in all of which 100% survival of fish was recorded. In all these treatments, significant inhibition of the enzyme was obtained. Considering the role of peroxidase in peroxide metabolism, inhibition of the enyzme (GPOD) may cause a break in the chain of events. This may lead to an overall imbalance in the homeostatis of the organism. (Baker-IVI)
W86-00429

EFFECT OF SIMULATED SULFURIC ACID RAIN ON THE CHEMISTRY OF A SULFATE-ADSORBING FOREST SOIL,
Pacific Northwest Environmental Research Lab., Corvallis, OR.
J. J. Lee.
Water, Air, and Soil Pollution, Vol. 25, No. 2, p 185-193, June, 1985. 4 Tab, 9 Ref.

Descriptors: *Acid rain, *Water pollution effects, *Forest watershed, *Soil chemistry, Adsorption, Sulfates, Nitrates, Calcium, Magnesium, Hydrogen ion concentration, Zinc.

Acidic deposition can potentially acidify unmanaged forest soils, leading to reduced productivity, tree mortality, and acidification of surface waters. Simulated sulfuric acid rain (pH 3.0, 3.5, 4.0) or control rain (pH 5.6) was applied for 3.5 yr to large lysimeter boxes containing a sulfate-adsorbing forest soil and either red alder or sugar maple seedlings. Elevated sulfate concentrations caused by the simulated sulfuric acid rain were most pronounced for the top 15 cm, but extended down to 45 cm (maple) or 75 cm (alder). No effects of sulfate concentrations were noted at depths of 75 to 90 cm, confirming the existence of a sulfate front between 20 cm and 100 cm. Decreases in Mg and Ca concentrations, base saturation, and soil H were limited to the uppermost 15 cm and, in most cases, to the pH 3.0 treatment. Concentration of Mg and Ca for the pH 3.0 treatments were greater than control at a depth of 15 to 30 cm, indicating transport of the cations from the soil surface. Na and K concentrations, and cation exchange capacity, were not affected by simulated sulfuric acid rain. Elevated concentrations of nitrate and extractable zinc throughout the alder systems indicate either increased rates of symbiotic N-fixation or decreased rates of N immobilization; and mobilization of Zn by all acid rain treatments. Acid deposition at rates typical of the most highly impacted region apparently can cause accelerated loss of bases in the top 15 cm of soil in some presumably insensitive ecosystems. (Baker-IVI)
W86-00430

BIOMASS AND STRUCTURE OF PHYTOPLANKTON IN KONIN LAKES IN THE YEARS 1976-1980,
Polish Academy of Sciences, Lomianki. Inst. of Ecology.
I. Spodniewska.
Ekologia Polska, Vol. 32, No. 2, p 289-305, 1984. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Biomass, *Konin Lakes, *Poland, *Lakes, *Phytoplankton, *Thermal pollution, Water pollution effects, Thermal powerplants, Water cooling, Heated water, Algae, Diatoms, Eutrophication.

Biomass and qualitative structure of phytoplankton were investigated in 4 heated lakes of the cooling system of Konin and Patnow thermal power stations. The lakes joined the cooling system at different times. The lakes vary in morphometry, turbulence, flow and intensity of the effect of heated water. The temperature of surface water in summer reaches the maximum of 27 C. No basic differences were observed in the phytoplankton biomass in lakes varying as to the length of time under the influence of heated water. The greatest phytoplankton biomass was recorded in shallow Goslawskie Lake in summer 1979. Mean phytoplankton biomass between May and September 1978 was also highest in Goslawskie Lake, about 6 mg/liter, and the lowest in the deepest lakes: Slesinskie and Mikorznskie (about 4 mg/l). In deep lakes intensive water blooms were not observed. During summer the phytoplankton biomass of these lakes ranged between 1 and 12 mg/l. The density of planktonic algae was very small in winter despite the high temperature of the water. Diatoms dominated in the plankton of all lakes, but their percentage in total phytoplankton biomass of particular lakes differed considerably. Undoubtedly the heating of Konin lakes results in great numbers of species of green algae in the phytoplankton. The constrained flow of water, especially in Lichenskie Lake, and water turbulence, do not create suitable condition for the intensive growth of this group of algae and for gradual substitution of diatoms by green algae and then by blue-green algae. Under the conditions in the Konin lakes, the great water mobility is undoubtedly a factor limiting intensive phytoplankton growth. (Baker-IVI)
W86-00438

EFFECT OF ZINC ON CADMIUM TOXICITY TO THE AMPHIPOD GAMMARUS PULEX,
Newcastle upon Tyne Univ. (England). Dept. of Zoology.
R. Howell.
Hydrobiologia, Vol. 123, No. 3, p 245-249, April, 1985. 3 Fig, 3 Tab, 23 Ref.

Descriptors: *Cadmium, *Toxicity, *Amphipods, *Zinc, *Estuarine environment, Water pollution effects, Heavy metals.

Because aquatic invertebrates are often exposed to increased concentrations of more than one toxic metal in the environment, antagonism between toxic metals may occur. Gammarus pulex were collected from sites in Northumberland, England and analyzed for total body zinc and cadmium concentrations. The toxicity of cadmium to animals from the different sites was compared with the initial total body zinc and cadmium concentrations of the animals from the site. The toxicity of cadmium to G. pulex was related to the initial total body zinc concentration but not to the initial total body cadmium concentration. In low zinc animals the susceptibility to cadmium poisoning was reduced by exposing the animals to a low concentration of zinc for 14 days. (Baker-IVI)
W86-00446

CONCORDANT VARIATION IN THERMAL TOLERANCE AND ALLOZYMES OF THE RED SHINER, NOTROPIS LUTRENSIS, INHABITATING TAILWATER SECTIONS OF THE BRAZOS RIVER, TEXAS,
North Texas State Univ., Denton. Dept. of Biological Sciences.
T. L. King, E. G. Zimmerman, and T. L. Beitinger.
Environmental Biology of Fishes, Vol. 13, No. 1, p 49-57, May, 1985. 1 Fig, 2 Tab, 43 Ref.

Descriptors: *Shiners, *Thermal pollution, *Thermal tolerance, *Allozymes, *Tailwater, *Brazos River, *Texas, Water pollution effects, Genetics, Dam effects, Stream regulation, Enzymes.

Critical thermal maxima (CTM) and genetic variation were compared for red shiners, Notropis lutrensis, from regulated and unregulated sites on the Brazos River in northcentral Texas. Tailwater fish acclimated to 25 C had significantly lower CTM's than those from a site upstream from the dam and unregulated downstream sites. Significantly different intrasite variances were observed, with two- and four-fold larger CTM variances in fish from within 1 km and 30 km of the dam. Genetic variation was determined from electrophoretic comparisons at 21 structural gene loci. Mean heterozygosity was greatest at regulated sites. Tests for locus heterogeneity at five variable loci indicated that regulated and unregulated populations are not homogeneous. Fish under regulation were genetically more similar to each other than they were to those not affected by regulation. The proportions of the gene variance attributable to habitat alteration were partitioned, and fully one-third of the gene variation was attributed to stream regulation. Patterns of variation in thermal tolerance and metabolic enzymes in the red shiner correlated closely with temperature regimes associated with hypolimnion release from the dam. These adaptive responses have occurred in less than 40 years. (Author's abstract)
W86-00452

ACCUMULATION, ELIMINATION AND CHEMICAL SPECIATION OF MERCURY IN THE BIVALVES MYTILUS EDULIS AND MACROMA BALTHICA,
Odense Univ. (Denmark). Biological Inst.
H. U. Riisgard, T. Kiorboe, F Mohlenberg, I. Drabaek, and P. P. Madsen.
Marine Biology, Vol. 86, No. 1, p 55-62, April, 1985. 5 Fig, 3 Tab, 31 Ref.

Descriptors: *Mercury, *Bioaccumulation, *Mussels, *Clams, *Chemical speciation, Water pollution effects, Organomercury compounds, Mercury compounds, Heavy metals.

Mussels (Mytilus edulis) transferred in net bags from clean to chronically mercury polluted water readily accumulated mercury during an exposure period of three months. Growth of the transplanted mussels had a 'diluting' effect on the mercury concentration, but the absolute weight of mercury uptake increased throughout the entire period, though there was a tendency for decreased efficiency of the removal of mercury per liter of water filtered by the mussels. Mussels were also translocated from polluted to clean (laboratory) water to depurate mercury. The biological half-life of mercury was 293 d for M. edulis from the chronically polluted area in contrast to only 53 d for mussels from a temporary massive mercury polluted area near a chemical deposit. In both cases about 75% of the total mercury in the mussels was inorganic, and it is suggested that both inorganic and organic mercury species were immobilized in mussels from the long-term mercury polluted area, whereas the immobilization capacity was exceeded in the short-term mercury exposed mussels near the chemical deposit. Very slow elimination of mercury was observed in the deposit-feeding bivalve Macoma balthica from the chronically polluted area, and about 6% of the total mercury was methyl- + phenyl-mercury. This is more than three times lower than found in M. edulis from the same collecting site. A pronounced difference in the mercury speciation (i.e., total mercury, total organic mercury, methyl-mercury and phenyl-mercury) in M. edulis from the two mercury polluted areas is thought to reflect the different character of the mercury pollution in the two areas. (Author's abstract)
W86-00453

HEAVY METAL CONTENT OF OYSTER, BLUE MUSSEL AND GROWING WATER IN HANSAN-GEOJE BAY (IN KOREAN),
Fisheries Research an Development Agency, Pusan (Republic of Korea).
G.-C. Hwang, S.-J. Kim, and E.-H. Lee.
Bulletin of the National Fisheries University of Pusan, Vol. 24, No. 1, p 121-128, 1984. 1 Fig, 5 Tab, 21 Ref.

Descriptors: *Heavy metals, *Mussels, *Oysters, *Hasan-Geoje Bay, *Korea, Mercury, Cadmium, Copper, Lead, Zinc, Aquaculture, Shellfish, Water pollution effects.

Quantitative analyses of heavy metals (Hg, Cd, Cu, Pb and Zn) in oyster, Crassostrea gigas, and blue mussel, Mytilus edulis, and growing water associated with hanging cultures in Hansan-Geoje Bay on the south coast of Korea were conducted during the period of July to December 1982. The contents of heavy metals in shellfish by growth, water depth, and species were discussed. Copper content of surface seawater was generally higher than that of five meter deep water with average values of 5.0 and 3.3 ppb, respectively. There were few differences in mercury content between the two water depths with average values of 0.132 and 0.137, respectively. Cadmium, lead and zinc were not detectable. In oysters, copper and zinc content showed a gradually increasing trend with increasing meat weight, whereas there were small variations in cadmium, lead and mercury during the study period; there were no differences between surface and five meter depths. The levels of heavy metals in oyster were consistently higher than that in blue mussel. Heavy metal content of both oyster and blue mussel in Hansan-Geoje Bay in October showed higher metal concentration in shellfish during the study period: The values were 0.55 and 0.21 ppm for cadmium, 6.42 and 0.66 ppm for copper, 0.69 and 0.41 ppm for lead, 101.6 and 18.4 ppm for zinc and 0.009 and 0.006 ppm for mercury, respectively. They were much less than the alert levels for oyster proposed by the Chemical Task Force of U.S. FDA 7th National Shellfish Sanitation workshop in 1977 which were 1,000-2,000 ppm for zinc, 42-175 ppm for copper, 1.5-3.5 ppm for cadmium, 2.0 ppm for lead and 0.2 ppm for mercury. (Author's abstract)
W86-00454

EFFECTS OF METAL SPECIATION ON GROWTH OF PHYTOPLANKTON WITH SPECIAL REFERENCE TO IRON,

Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. de Haan.
Hydrobiological Bulletin, Vol. 18, No. 2, p 85-94, December, 1984. 6 Fig, 45 Ref.

Descriptors: *Phytoplankton, *Algal growth, *Metals, *Chemical speciation, *Iron, Lake Tjeukemeer, Netherlands, Ion exchange, Toxicity, Complexation, Chelation, Electrostatic attraction, Diatoms, Eutrophication.

A compilation of studies is reviewed concerning the effects of metal speciation on the growth of phytoplankton. In particular, attention is directed to the speciation and availability of iron in Lake Tjeukemeer, The Netherlands. Free ionic metal species generally appear to be most effective in determining metal availability and toxicity under laboratory conditions. Metal speciation is affected by a variety of factors controlling solubility, ion-exchange, complexation or chelation, sorption and electrostatic attraction of metal ions. Most of these factors result in reduced availabilities. In some cases, particular organic metal chelates such as citrates, nitrilotriacetates and the specifically iron chelating siderophores, are more available than the corresponding free ions. Other metals present also influence the availability of a given metal by competing for the same binding sites on the algal cell. In the eutrophic, alkaline, hard and humic lake Tjeukemeer, the free Fe(3+) concentration is below measurable levels and does not match the iron requirement of the phytoplankton, so most of the algal iron must have been provided by the predominant inorganic iron colloids and particles by dissolution or photodegradation. Different phytoplankton species vary widely in their metal requirements and tolerances. Therefore, metal speciation and availability may affect species composition and succession within phytoplankton communities. (Baker-IVI)
W86-00455

CONTENTS OF CD, FE, MN AND ZN IN THE TISSUE OF KATELYSIA HIANTINA COLLECTED FROM TOLO HARBOUR, AN ALMOST LAND-LOCKED SEA,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
M. H. Wong, and K. C. Au.
Hydrobiological Bulletin, Vol. 18, No. 2, p 95-101, December, 1984. 2 Fig, 3 Tab, 27 Ref.

Descriptors: *Clams, *Toxicity, *Heavy metals, *Tolo Harbor, *Hong Kong, Cadmium, Iron, Manganese, Zinc, Sediments, Mine tailings, Water pollution effects.

Samples of Katelysia hiantina (an edible clam) and sediments were collected from iron ore tailings and other nearby sites within Tolo Harbor (Hong Kong) for heavy metal analysis. The water quality of the harbor has deteriorated in recent years due to high inputs of nutrients, and reduced dilution and tidal flushing because of land reclamation and the enclosure of Plover Cove for use as a reservoir. The sediments, as well as the clams at the tailings, contained higher concentrations of Cd, Fe, Mn and Zn. Positive correlations between the metals in the sediments and clam tissues were found. The clams collected from the tailings showed a substantial loss of Fe, Mn and Zn when reared in clean filtered seawater for 8 days. (Baker-IVI)
W86-00456

SURVEY OF THE DISTRIBUTION OF CHIRONOMIDAE (DIPTERA, INSECTA) OF THE RIVER RHINE BY SAMPLING PUPAL EXUVIAE,
Bristol Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00457

HYPERSCUMS OF THE CYANOBACTERIUM MICROCYSTIS AERUGINOSA IN A HYPERTROPHIC LAKE (HARTBEESPOORT DAM, SOUTH AFRICA),
National Inst. for Water Research, Pretoria (South Africa).
T. Zohary.
Journal of Plankton Research, Vol. 7, No. 3, p 399-409, 1985. 4 Fig, 2 Tab, 35 Ref.

Descriptors: *Microcystis, *Hyperscum, *Scum, *Hartbeespoort Dam, *South Africa, Cyanophyta, Eutrophication, Chlorophyll a, Photosynthesis, Anoxic conditions, Hydrogen ion concentration.

It is proposed that surface scums of densely packed planktonic cyanobacteria (blue-green algae) which exist for weeks to months, measure several decimeters in thickness and are covered by a crust of photo-oxidized cells, be called hyperscums. Hyperscums of Microcystis aeruginosa formed during prolonged periods of calm weather in wind-protected sites in a hypertrophic lake subject to low wind speeds (Hartbeespoort Dam, South Africa). A hyperscum that extended over 1-2 hectares and persisted for 103 days during winter 1983 was studied. Chlorophyll a concentrations ranged from 100 to 300 mg/l. Microcystis cell concentrations reached 1.76 x 10 to the 9th power cells/ml or 116 cu cm/l. The hyperscum environment was anoxic, aphotic, with a fluctuating temperature regime and low pH values. The densely packed Microcystis cells survived these conditions for more than 2 months. This was shown by comparing the potential photosynthetic capacity of Microcystis from the hyperscum with that of Microcystis from the main basin of the lake. However, after 3 months the hyperscum algae lost their photosynthetic capacity and decomposition processes prevailed. The hyperscum gradually shrank in size until a storm caused its complete disintegration. (Author's abstract)
W86-00519

MEIOFAUNA ASSOCIATED WITH MANGROVES IN THE HUNTER RIVER ESTUARY AND FULLERTON COVE, SOUTH-EASTERN AUSTRALIA,
Australian National Univ., Canberra. Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W86-00521

CHANGES OF FLORA AND VEGETATION OF THE CALCAREOUS STREAMS IN THE 'FRIEDBERGER AU' (NEAR AUGSBURG) BETWEEN 1972 AND 1982 UNDER CHANGING POLLUTION CONDITIONS (VERANDERUNGEN VON FLORA UND VEGETATION IN DEN KALKREICHEN FLIESSGEWASSERN DER FRIEDBERGER AU (BEI AUGSBURG) VON 1972 BIS 1982 UNTER VERANDERTEN BELASTUNGSBEDINGUNGEN),
Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Landeskultur und Pflanzenokologie.
A. Kohler, and S. Schiele.
Archiv fur Hydrobiologie, Vol. 103, No. 2, p 137-199, 1985. 9 Fig, 5 Tab, 12 Ref.

Descriptors: *Aquatic plants, *Water pollution effects, *Friedburger Au, *Germany (Federal Republic), Calcareous streams, Wastewater pollution, Vegetation, Macrophytes,.

The Friedberger Au lies in the Lech-Wertach-Ebenen Nature Area in the immediate neighborhood of Augsburg. The flora and vegetation of a calcareous stream in the Friedberger Au was mapped in 1972, 1978 and 1982. Wastewater pollution in the Friedberger Au changed between 1972 and 1982. The most important change was the diversion of wastewater from the city of Friedberg in 1974 to treatment facilities in Lech and Paar. Other communities in the area introduced improved treatment during this period. The alteration of flora and vegetation under changing pollution conditions was studied. Macrophytic recolonization of a formerly overloaded zone took at least 8 years. Some species have not recolonized this part of the stream. Nearby ditches which were initially oligotrophic showed both qualitative and quantitative increases in eutrophic species and decreases in oligotrophic species due to increasing pollution load. (Moore-IVI)
W86-00524

PROBLEM OF SARDINE FISHERIES IN EGYPT,
Institute of Oceanography and Fisheries, Alexandria (Egypt).
N. F. Bishara.
Archiv fur Hydrobiologie, Vol. 103, No. 2, p 257-265, 1985. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Water pollution effects, *Dam effects, *Sardines, *Commercial fisheries, *Egypt, Nile River, Aswan High Dam, Environmental effects, Wastewater pollution, Plankton.

In Egypt, sardines are caught along the Mediterranean coast from Alexandria to El-Arish with points of concentration at Alezandria, Rosetta, Damietta, Abu Kir bay and Port Said. From 1966 to 1978, there was a marked decrease in sardine landings along the Mediterranean coast of Egypt. Factors responsible for this decline include the construction of the high dam at Aswan in 1964; and increased water pollution by sewage and industrial wastes. The Aswan High Dam greatly reduced the flow of the Nile, and also reduce plankton production in the Mediterranean waters. In the period from 1978 through 1981, sardine fisheries seemed to be thriving once more. (Moore-IVI)
W86-00525

EFFECT OF ADHERENT BACTERIA AND BACTERIAL EXTRACELLULAR POLYMERS UPON ASSIMILATION BY MACOMA BALTHICA OF SEDIMENT-BOUND CD, ZN AND AG,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. W. Harvey, and S. N. Luoma.
Marine Ecology - Progress Series, Vol. 22, No. 3, p 281-289, March, 1985. 2 Fig, 4 Tab, 22 Ref.

Descriptors: *Bacteria, *Exopolymers, *Clams, *Cadmium, *Zinc, *Silver, Sediments, Particulate matter, Bioavailability, Heavy metals, Estuarine environment, Behavior.

Effects of adherent bacteria and bacterial extracellular polymer (exopolymer) upon uptake of particle-bound Cd, Zn and Ag by the deposit-feeding clam Macoma balthica were studied in the laboratory. Amorphous iron oxyhydroxide and unaltered and alkaline-extracted sediments were used as model particulates in separate, controlled deposit-feeding experiments. In general, amounts of metal taken up from ingested particles varied dramatically with the nature of the particle surface. Ingestion of contaminated iron oxide particles did not contribute to overall uptake of Cd and Ag in feeding clams, but accounted for 89 to 99% of total Zn uptake. Exopolymer adsorbed on iron oxide particles caused an increase in the biological availability of particle-bound metals in the order Ag > Cd > Zn, whereas adherent bacteria up to 3.2 x 10 to the 11th/g had no effect upon amounts of metal taken up from ingested particulates. At the higher Cd and Ag concentrations employed (3.6 x 10 to the -7 M), feeding rates declined with increasing amounts of iron oxide-bound exopolymer, suggesting behavioral avoidance due to increased metal availability. Much of the Cd (57%) taken up by clams feeding on unaltered estuarine sediments originated from particulates, even though particle/solute distribution of Cd (86%) was similar to that in experiments with iron oxide particles. Uptake of Cd from alkaline-extracted sediments was insignificant, as it was from unamended iron oxide. However, addition of exopolymer (10 mg/g sediment) caused a restoration in bioavailability of sediment-bound Cd. (Author's abstract)
W86-00528

COMPARISON OF THE TOXIC EFFECTS OF TWO PESTICIDES ON THE TESTES OF A FRESH WATER TELEOST CHANNA STRIATUS BL.,
Government Coll., Mhow (India). Dept. of Zoology.
N. Arora, and S. K. Kulshrestha.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 435-441, 1984. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Pesticide toxicity, *Channa, *Carbaryl, *Endosulfan, Toxicity, Fish, Carbamate pesticides, Chlorinated hydrocarbon pesticides, Testes.

A comparative study was made of the toxic effects of sublethal doses of two extensively used pesticides, a carbamate compound carbaryl and an organochlorinated compound endosulfan on the testes of a fresh water teleost, Channa striatus. Male specimens were exposed to 10 and 20 ppm carbaryl and 0.00075 and 0.001 ppm of endosulfan for a period of 30 d. At both dose levels, carbaryl and endosulfan produced the following effects: rupture of the peritoneal lining; rupture of the wall of seminiferous lobules; failure of spermatogenesis at the spermatid stage; necrosis of interstitial cells; and fibrosis of the connective tissue. There was a progressive reduction in different stages of the spermatogenetic activity with an increase in the duration of the exposure. After 30 d of exposure only spermatogonia were seen. (Moore-IVI)
W86-00544

ENVIRONMENTAL BEHAVIOR OF FLUOROTENSIDES; PART 1: WATER TOXICITY TESTING (ZUM UMWELTVERHALTEN VON FLUORTENSIDEN; TEIL 1: PRUFUNG AUF AQUATOXIZITAT),
Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Organische Chemie.
D. Prescher, U. Gross, J. Wotzka, M. Tscheu-Schluter, and W. Starke.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 595-600, 1984. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Surfactants, *Fluorotensides, *Toxicity, Guppies, Algae, Water pollution effects, Water quality standards.

Poecilia reticulata Peters (guppy) and the green alga Monoraphidium griffithii were used for testing of different fluorotensides. After the representation of the methods of investigation and the definition of criteria of toxicity the results obtained by the investigation are discussed. In general, the toxicity of the four investigated fluorotensides to algae was lower than to fish. The anionic fluorotenside CF3-(CF2)n-CFH-COONa was an exception. The results are summarized in tables and diagrams. Finally, for the condition of the receiving-water biocenosis class '2' the respective still permissible matter concentrations are proposed. They vary between 0.05 and 0.2 mg/l. (Author's abstract)
W86-00546

ALDRIN INDUCED CHANGES IN THE ACTIVITIES OF THREE PHOSPHATASES OF MACROBRACHIUM LAMARREI (H. MILNE EDWARDS),
Gorakhpur Univ. (India). Dept. of Zoology.
O. R. Murti, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 609-613, 1984. 1 Tab, 24 Ref.

Descriptors: *Aldrin, *Enzymes, *Macrobrachium, Fish, Toxicity, Pesticide toxicity, Metabolism, Stress.

Macrobrachium lamarrei was exposed to 0.008, 0.017 and 0.021 mg/l aldrin (0.4, 0.8 and 1.0 of the LC50,96h) for 24-96h and after exposure the activities of the acid, alkaline and glucose-6-phosphatases are determined. With concentration and time of exposure the acid phosphatases shows an increasing activity up to 170% compared with the control, which is interpreted as part of prenecrotic changes in the cells. With concentration and time of exposure the alkaline phosphatase shows a decreasing activity down to 20% of the control, which is indicative of considerable disturbances of the total metabolism. The glucose-6-phosphatase shows an increasing activity with the aldrin concentration up to 150% during 72 h; then the activity drops to 60-80%. The initial rise in the glucose concentration of blood caused by that is the clear consequence of a stress reaction and the change of metabolism resulting from it. (Author's abstract)
W86-00547

STUDIES ON THE TOXICITY OF SOME INSECTICIDES TO A FRESHWATER TELEOST LEBISTES RETICULATUS (PETERS),
K.L.D.A.V. Coll., Roorkee (India). Dept. of Zoology.
P. K. Gupta, V. S. Mujumdar, and P. S. Rao.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 629-636, 1984. 4 Tab, 37 Ref.

Descriptors: *Insecticides, *Toxicity, *Lebistes, Fish, Pesticide toxicity, Endosulfan, Lindane, Aldrin, Chlordane, Rogor, Novocrom.

The toxicity of endosulfan, lindane, aldrin, chlordane, rogor and novocrom to the freshwater fish Lebistes reticulatus was investigated for exposure periods of 12-96 h in batch tests with daily exchange of the medium. The mean survival periods and the LC50 were determined. During the early hours of exposure to the insecticides, the opercular movements of the fish decreased. Later the opercular movements increased, and the fish swam erratically, lost balance, and died. Toxicity increases in the following sequence (LC50,96h) (in mg/l): novocron (22.65), rogor (18.97), chlordane (0.341), aldrin (0.017), lindane (0.0160), endosulfan (0.0027). The following safe concentrations in mg/l are recommended: 0.0006 endosulfan, 0.0041 lindane, 0.0010 aldrin, 0.1436 chlordane, 5.4086 rogor and 7.2309 novocron. Presumable safe concentrations of the insecticides to the fish are a fraction of their respective LC50 values and may help to a great extent in determining water quality criteria. (Moore-IVI)
W86-00548

ACUTE TOXICITY OF MERCURIC CHLORIDE AND CADMIUM CHLORIDE TO FRESHWATER PRAWN, MACROBRACHIUM LAMMARREI (H. MILNE EDWARDS),
Gorakhpur Univ. (India). Dept. of Zoology.
R. Murti, and G. S. Shukla.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 689-692, 1984. 1 Tab, 16 Ref.

Descriptors: *Prawn, *Toxicity, *Mercuric chloride, *Cadmium chloride, Mercury compounds, Cadmium compounds, Behavior, Mortality, Crustaceans.

Toxicity of HgCl2 and CdCl2 in Macrobrachium lamarrei (H. Milne Edwards) was demonstrated in aquarium tests conducted with field-collected Indian specimens over test periods of 24-96 hr. The LC sub 50 for HgCl2 ranged from 0.167 mg/l (24 hr) to 0.095 (96 hr); the respective figures for CdCl2 were 0.374 mg/l and 0.195 mg/l, indicating that CdCl2 is somewhat less toxic. Tests were conducted at pH 7.4 +/- 0.2 and 26 C +/- 1.5 C. Organisms became excited and exhibited spontaneous swimming just after transfer to test solutions of both chemicals, and lost their balance and settled to the bottom very soon in mercuric chloride and after about an hour in cadmium chloride solution. A thin film of mucus was observed in the gill region of CdCl2-exposed prawns, but was not well-marked in those exposed to HgCl2. No mortality was observed up to 96 hr in 0.050 mg/l HgCl2; the comparable figure for CdCl2 was 0.12 mg/l. M lamarrei appears to be the most sensitive of all crustaceans to these two metals, but it is difficult to make comparisons with other species because of differences in temperature optima. (Rochester-IVI)
W86-00553

RELATIVE TOXICITY OF PHENOXY HERBICIDES ON LEBISTES (POECILIA) RETICULATUS (PETERS),
Udaipur Univ. (India). Dept. of Limnology and Fisheries.
H. K. Vardia, and V. S. Durve.
Proceedings of the Indian Academy of Sciences (Animal Sciences), Vol. 93, No. 7, p 691-695, December, 1984. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Herbicides, *Toxicity, *Lebistes, *Phenoxy herbicides, Aquatic weed control, Pesticide toxicity, 2,4-D, Regression analysis, Dichlorophenoxyacetic acid.

Phenoxy herbicides (2,4-D, its sodium and ethyl amine salts and ethyl esters) commonly used in aquatic weed eradication programs, were tested by acute and static bioassay investigations on a cyprinid fish Lebistes (Poecilia) reticulatus under laboratory conditions. The toxicities of these different formulations are compared and reported in relative toxicity ratings. 'Safe application rate' and 'safe application factor' equations were also calculated. Median lethal concentrations at various time intervals are also reported along with respective fiducial limits and regression equations. Comparative regressions are drawn for three time intervals, 24, 48 and 96 hr. (Author's abstract)
W86-00577

PATTERNS OF BIOACCUMULATION OF AN ESSENTIAL TRACE ELEMENT (ZINC) AND A POLLUTANT METAL (CADMIUM) IN LARVAE OF THE PRAWN PALAEMON SERRATUS,
Institut Francais de Recherche pour l'Exploitation de la Mer, Nantes (France). Lab. Effets Biologiques des Nuisances.
J. Devineau, and C. A. Triquet.
Marine Biology, Vol. 86, No. 2, p 139-143, May, 1985. 4 Fig, 1 Tab, 28 Ref.

Descriptors: *Bioaccumulation, *Zinc, *Cadmium, *Prawn, Larval growth stage, Water pollution effects, Heavy metals, Crustaceans.

Palaemon serratus Pennant larvae from females caught near Roscoff (France) of the Bay of Biscay in 1983, were reared in the laboratory. From hatching to the first stage after metamorphosis, the larvae were exposed to zinc and cadmium introduced separately or together into the rearing medium. At the end of experimental contamination, the concentrations of the two metals in the organisms were determined. The level of zinc in organisms was mainly independent of its concentration in the water, suggesting that the bioaccumulation of this essential trace element is controlled by some physiological process. The accumulation of cadmium in the larvae paralleled the overloads of this metal in the water. Increased zinc concentrations in water have little or no effect on the cadmium levels in organisms. The most important interaction between these two metals is an antagonism exerted by cadmium on the biological uptake of zinc. (Author's abstract)
W86-00580

RELATIONS BETWEEN BIOACCUMULATION AND WEIGHT OF ORGANISMS,
Swedish Water and Air Pollution Research Lab., Stockholm.
P.-E. E. Bergner.
Ecological Modelling, Vol. 27, No. 3/4, p 207-220, April, 1985. 6 Fig, 17 Ref.

Descriptors: *Bioaccumulation, *Fate of pollutants, *Aquatic organisms, Accumulation, Metabolism.

Empirical bioaccumulation data indicate the existence of systematic relations between the extensive quantity size of organism and the intensive quantity weight concentration of accumulating substances. The characteristic co-variation between body weight and weight concentration observed in organisms is rationalized on the basis of simple and biologically reasonable postulates. In particular it turns out that the frequently assumed connection between weight concentration and age is not a prerequisite in order to explain the observed phenomenon. The basic principles to be applied are that a change in an organism's size does not directly alter the metabolism of the individual cells, and that usually the total uptake of most substances by an organism increases with the organism's size. The conclusion is drawn that, when working on problems that involve bioaccumulation processes, the absolute size of organisms should be included in the analysis, no matter what specific model is applied. (Baker-IVI)
W86-00594

PHYSIOLOGICAL RESPONSES TO POLLUTION,
Institute for Marine Environmental Research, Plymouth (England).
J. Widdows.
Marine Pollution Bulletin, Vol. 16, No. 4, p 129-134, April, 1985. 2 Fig, 31 Ref.

Descriptors: *Water pollution effects, *Physiological ecology, Physiological responses, Aquatic animals, Monitoring, Toxicology.

The measurement of changes in the physiological responses of individual organisms should form an important component of any toxicological or environmental monitoring program. The rate of growth is a fundamental component of physiological fitness and therefore represents an important index of environmental (pollutant) effect. An additional index can be calculated from the physiological components of the energy equation in order to provide further information on the efficiency with which an animal functions. Shell growth measurement, where appropriate, can serve to integrate and record changes in environmental quality over a period of weeks or months. Reproductive processes form a critical interface between the individual and the population. Behavioral responses, including bivalve shell gape and rate of byssal attachment have been suggested as simple methods of monitoring changes in environmental quality, but they are generally difficult to quantify and interpret. In order to calculate the assimilative capacity (or rate) of receiving waters by means of environmental quality models it is necessary to identify toxic contaminants, identify and characterize the sources and sinks of contaminants, identify the key resource to be protected, and establish dose-response relationships for relevant contaminants and appropriate target organisms. Physiological measurements of pollution impact therefore have an important role in environmental pollution monitoring. (Baker-IVI)
W86-00597

ASSESSMENT OF THE BIOLOGICAL EFFECTS OF SEWAGE SLUDGE AT A LICENSED SITE OFF PLYMOUTH,
Water Research Centre, Marlow (England).
T. J. Lack, and D. Johnson.
Marine Pollution Bulletin, Vol. 16, No. 4, p 147-152, April, 1985. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Water pollution effects, *Sludge disposal, *Plymouth, *England, Marine pollution, Toxicity, Mussels, Metals, Enzymes.

Mussels were placed in cages at sites were chosen to lie along a hypothetical pollution gradient. Two cages were held 4 m below the surface and two 4 m above the sea bed. The depths of water ranged from about 10 m at Site 1 to about 60 m at Site 7. There is an indication that animals in the upper cages were more stressed by the sewage disposal than animals in the lower cages. The lowest scope for growth (SFG) was found in the upper animals at site 5 on the edge of the sludge disposal ground, with significant improvements in SFG moving inshore to site 1 and offshore to site 7. Of the upper animals, those at sites 2, 3, 5, and 6 had significantly lower SFG than at site 1. There was no significant difference between the lower animals except those at site 2, where the lowest SFG was recorded. Concerning lysosomal stability, all the animals from the upper cages showed significantly more stress than the control animals. For the animals contained within the upper cages the most stressful site was at the center of the disposal ground, with progressively less stress being detected at the sites away from the ground. The inshore site was the least stressful for both upper and lower animals although only two sections of the lower animals were assayed. The upper caged animals had elevated levels of organic detoxication enzymes and there was evidence of two possible sources of stress; land based or estuarine inputs affecting animals near the shore at sites 1 and 2 and sewage sludge affecting animals around the disposal ground at sites 5, 6, and 7. The lower cages anmials showed evidence that a metal detoxication system had been induced. It appeared that two sources may be involved; land-based, estuarine and metal-enriched sediments affecting the near shore and shallower sites and sewage sludge affecting those animals closest to the disposal ground. (Baker-IVI)
W86-00599

FISH GILL STRUCTURAL CHANGES INDUCED BY TOXICANTS AND OTHER IRRITANTS: A STATISTICAL REVIEW,
Washington State Univ., Pullman. Dept. of Zoology.
J. Mallatt.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 630-648, April, 1985. 1 Fig, 7 Tab, 130 Ref.

Descriptors: *Water pollution effects, *Fish, *Gills, *Reviews, Toxicity, Histology, Pathology, Irritants, Statistical studies, Morphology, Osmolality, Ultrastructure.

The literature on how fish gill morphology is affected by chemical and physical irritants in the surrounding water (e.g. various toxicants, extremes of temperature or pH) is quantitively reviewed. Histopathological gill lesions that were reported are catalogued, and statistics are to explore how such lesions relate to the irritant-exposure conditions under which they occurred (specifically, to dose and class or irritant, to temperature, and to salinity of the surrounding water). Frequently recorded histopathologic lesions include changes in gill epithelium (lifting, necrosis, hyperplasia, rupture), bulbing or fusing of gill lamellae, hypersecretion and proliferation of mucocytes, and changes in chloride cells and gill vasculature. It is concluded that these lesions are largely nonspecific in nature, as each was detected under many different exposure conditions. The lesions are not entirely independent of exposure conditions, however, as the statistical analysis discerns these trends: (1) Most gill lesions types have been reported more frequently after lethal than after sublethal exposure of irritants. (2) Some lesions were more frequently detected in studies employing heavy metals than in studies using organic toxicant or other irritants; such lesions include necrosis and hypertrophy of gill epithelial cells, plus mucous hypersecretion. (3) Lifting of the branchial epithelium, the most commonly reported lesion, was reported more often in freshwater than in marine fish, suggesting the osmolarity of the ambient water influences this lesion. Little relation was found between recorded lesion frequencies and temperature. Following the statistical analysis, the etiology of irritant-induced gill lesions is considered. The nonspecificity, of branchial alteration suggests that they primarily represent sterotyped physiological reactions of gills to stress, and many of them are logically considered defense responses. Some branchial alterations have been considered inflammatory, but it is concluded that the literature cannot support that hypothesis. Ultrastructural studies have detected irritant-induced disruptions of branchial epithelial cells, including cytoplasmic vacuolization, autophagosomes and inclusions, loss of microvilli, and abnormal mitochondria and nuclei. (Author's abstract)
W86-00602

WHOLE-LAKE FERTILIZATION EXPERIMENTS IN COASTAL BRITISH COLUMBIA LAKES: EMPIRICAL RELATIONSHIPS BETWEEN NUTRIENT INPUTS AND PHYTOPLANKTON BIOMASS AND PRODUCTION,
Department of Fisheries and Oceans, Vancouver (British Columbia). West Vancouver Lab.
J. G. Stockner, and K. S. Shortreed.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 649-658, April, 1985. 7 Fig, 2 Tab, 37 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Biomass, *Lakes, *British Columbia, *Fertilization, Monomictic, Nitrogen, Phosphorus, Trophic level, Nutrients, Chlorophyll.

Seventeen warm monomictic coastal lakes in British Columbia were studied from 1980 to 1983. Inorganic nitrogen and phosphorus were applied to 13 of the lakes in some or all years of the study. In the untreated condition, lakes were ultraoligotrophic with low concentrations of nutrients (1.0-4.1 micro-g total P/L at spring overturn), of average summer chlorophyll (0.49-2.57 micro-g/L), and of average daily primary production (3.0-10.5 mg C/cu m/d). The lakes' oligotrophic condition is sustained by their low residence time (0.2-7.3 yr) and by low nutrient inputs from the generally steep granitic drainage basins. The lakes respond predictably to nitrogen and phosphorus additions and are generally phosphorus limited, as shown by the significant positive relationships between average summer chlorophyll and total phosphorus at spring overturn (r sq = 0.81) in unfertilized lakes, between average summer chlorophyll and phosphorus load from fertilizer (r sq = 0.62) in fertilized lakes, by the high average particulate C:N:P ratios (152:20:1), and by the high average TN:TP ratio (89). (Author's abstract)
W86-00603

ACIDIFICATION EFFECTS ON STREAM BIOTA AND ORGANIC MATTER PROCESSING,
Michigan State Univ., East Lansing. Dept. of Zoology.
T. M. Burton, R. M. Stanford, and J. W. Allan.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 669-675, April, 1985. 2 Fig, 5 Tab, 19 Ref.

Descriptors: *Stream biota, *Organic matter, *Acidification, Water pollution effects, Decomposition, Leaves, Detritus, Invertebrates, Acid streams, Aquatic insects, Isopods, Snails, Mortality.

Experimental acidification effects on stream biota and organic matter decomposition rates in natural, low alkalinity (7-15 mg CaCO3/L) Michigan streams were studied using paired, artificial, recirculating streams. Acidification to pH 4 with sulfuric acid from pH 7.0 to 7.4 resulted in significant decreased decomposition rates for 5-g leaf packs of white birch (Betula papyrifera) and sugar maple (Acer saccharum). Populations of total macroinvertebrates on leaf packs in the acid stream substantially reduced over a 264-d exposure period, whereas populations remained unchanged in the control stream. Detailed studies were conducted on a caddisfly, Lepidostoma liba, and an isopod, Asellus intermedius. The Lepidostoma population was resistant to short-term exposure to acidification, but significant mortality occurred after 80 d at pH 4 at 2-4 C. Late instars were not affected by acidification and emerged after more than 60 d at 15-20 C. Asellus was very sensitive to acidification with up to 93% mortality after only 24 d and with inhibition of reproduction. Acidification also reported in increased mortality for a snail, Physa heterostropha, and another caddisfly, Pycnopsyche sp. (Author's abstract)
W86-00604

DEPTH DISTRIBUTION AND BIOMASS OF SUBMERSED AQUATIC MACROPHYTE COMMUNITIES IN RELATION TO SECCHI DEPTH,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W86-00606

INFLUENCE OF PH, WATER HARDNESS, AND ALKALINITY IN THE ACUTE LETHALITY OF ZINC TO RAINBOW TROUT (SALMO GAIRDNERI),
Guelph Univ. (Ontario). Dept. of Zoology.
R. W. Bradley, and J. B. Sprague.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 731-736, April, 1985. 1 Fig, 2 Tab, 38 Ref.

Descriptors: *Toxicity, *Zinc, *Trout, *Hydrogen ion concentration, *Alkalinity, *Hardness, Water pollution effects, Mortality, Carbonates, Chemical precipitation, Dissolved solids.

The acute lethality of dissolved zinc to rainbow trout (Salmo gairdneri) was significantly increased

at higher pH and lower hardness levels. Changes in pH from 5.5 to 7.0 increased zinc toxicity by factors to 2 to 5, depending on total hardness levels. A decrease in hardness from 386 to 31 mg CaCO3/L increased zinc toxicity by more than an order of magnitude at both pH levels. These effects of pH and hardness were not caused by changes in the chemical speciation of zinc. An increase in carbonate alkalinity from 8.4 to 24 mg CaCO3/L at pH 7.0 did not significantly alter zinc toxicity at either hardness level. Thus, carbonate alkalinity is not an important factor at or below pH 7.0. At low hardness, dissolved zinc was more than 10 times as toxic at pH 9.0 as at pH 5.5. Two competing mechanisms appear to operate: as the pH rises, dissolved zinc becomes increasingly toxic, but at higher pH levels it is increasingly replaced by zinc precipitate, which is of very low toxicity to fish. (Author's abstract)
W86-00608

POSTSETTLEMENT DIATOM SUCCESSION IN THE BAY OF QUINTE, LAKE ONTARIO,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
E. F. Stoermer, J. A. Wolin, C. L. Schelske, and D. J. Conley.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 754-767, April, 1985. 9 Fig, 2 Tab, 30 Ref. EPA grant R810396, NSF grant OCE-8216588.

Descriptors: *Diatoms, *Succession, *Bay of Quinte, *Lake Ontario, *Ontario, History, Eutrophication, Silica, Fossils, Chrysophyta, Mining, Water pollution effects.

Siliceous algal microfossil assemblages deposited in the Bay of Quinte prior to European settlement consist of low numbers of benthic diatoms and chrysophyte cysts. Early settlement activities are marked by qualitative changes in the flora and small increases in microfossil flux. Events associated with the Ambrosia horizon produced a rapid transition from assemblages characteristic of oligotrophic environments to those characteristic of eutrophic waters and a large increase in microfossil flux. This was followed by a period of decreasing siliceous microfossil flux and reestablishment of less eutrophic species ca. 1853-61. Minimum siliceous algal microfossil flux and highly atypical assemblages occurred in the period ca. 1879-88, which corresponds to the period of intensive mining activities in the Bay of Quinte watershed. Maximum flux of siliceous microfossil occurred ca. 1900 and declined thereafter, although composition of assemblages deposited indicates increasing eutrophy and displacement of summer-blooming species. This is interpreted as evidence of beginning of summer silica limitation. Based on microfossil evidence, the modern eutrophic flora of the bay was established by 1928. (Author's abstract)
W86-00609

EFFECTS OF LOW ENVIRONMENTAL PH ON THE SURVIVAL, GROWTH AND IONIC COMPOSITION OF POSTEMERGENT ATLANTIC SALMON (SALMO SALAR),
Department of Fisheries and Oceans, St. Andrews (New Brunswick). Fisheries Research Branch.
G. L. Lacroix, D. J. Gordon, and D. J. Johnston.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 42, No. 4, p 768-775, April, 1985. 3 Fig, 2 Tab, 30 Ref.

Descriptors: *Salmon, *Hydrogen ion concentration, *Water pollution effects, Immature growth stages, Bioassay, Mortality, Growth, Calcium, Sodium, Westfield River, Nova Scotia.

Postemergent Atlantic salmon (Salmo salar) were reared during the early feeding phase in the soft, acidic water of the Westfield River (mean pH 5.0) in Nova Scotia. The fry were held in a flow-through system of tanks in situ and were fed a hatchery diet. Bioassays were also conducted in river water treated with limestone (mean pH 6.1) to provide a control. Cumulative mortality of fry after 30 d in the tanks was 70% at pH 5.0 and only 4% at pH 6.1. Fry in untreated river water were inactive, ingested little food, and lost weight (approximately 25%) during the first 15 d of exposure. Large increases in body (Ca(2+)) and (Na(+)) were observed in fry at both pH levels during that time, but the increase in (Ca(2+)) lagged and that in (Na(+)) was less in fry at low pH. Deaths occurred 15-30 d after swim-up and dead fry were all severely emaciated, indicating the deaths were probably from starvation. Although there were differences in ionic composition changes in fry held at pH 5.0 compared with control, no major depletion of body ionic reserves occurred relative to initial concentrations. Surviving fry a pH 5.0 developed a tolerance after 25 d and had growth rates, condition factors, and ionic concentrations similar to those to fry in treated water. The mortality of fry during the transition to exogenous feeding, in response to low pH stress in soft water, is probably responsible for reduced recruitment and the decline or loss of salmon stocks in this and other acidic rivers of Nova Scotia. (Author's abstract)
W86-00610

5D. Waste Treatment Processes

INNOVATIVE/ALTERNATIVE WASTEWATER COLLECTION SYSTEMS FOR CORPS OF ENGINEERS RECREATION AREAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
M. J. Cullinane.
Miscellaneous Paper EL-81-7, September 1981. 36 p, 10 Ref.

Descriptors: *Wastewater treatment, *Wastewater collection, *Sewer systems, *Septic tanks, *Recreation facilities, Wastewater disposal, Pressure sewer systems, Vacuum sewer systems, Gravity flow.

Design considerations are given for several wastewater collection and transmission alternatives for recreation areas. Choice of a system is site-specific. The conventional gravity collection system is easy to maintain, expand, and operate; however, capital costs are high, especially if terrain or excavation problems exist. Pressure systems are of two types: (1) GP, which has a holding tank, grinder pump, electrical and mechanical components, and collection system piping and (2) STEP, which has a septic tank, one-site pressurization unit, and collection system piping. Vacuum systems have a central vacuum source to maintain a constant vacuum on the main line of the collection systems. Small-diameter gravity systems, not widely used in the U.S., include on-site septic tanks that drain into small-diameter gravity sewers. Cost information is provided for each system.
W86-00331

MEMBRANE CONTROLLED PROCESSES FOR THE ENERGY-EFFICIENT CONVERSION OF SLUDGES TO FUELS AND MARKETABLE CHEMICALS.
Columbia Univ., New York.
Available from the National Technical Informatin Service, Springfield, VA 22161 as DE82013685. Department of Energy, Washington, DC. Office of Renewable Technology. Report DOE/CS/20400-1. March 1982. 254 p. 69 Fig, 26 Tab, 106 Ref. Contract/Grant No. DE-AC01-78CS20400.

Descriptors: *Wastewater treatment, *Byproducts, *Membrane processes, Anaerobic digestion, Aerobic treatment, Sludge digestion, Municipal wastes, Solid wastes.

The development of a process for the membrane-controlled conversion of urban solid wastes and sludges into fuels and marketable chemicals is reported. It is highly cost-effective and energy efficient because of the substantial value of the chemical by-products obtained. Sludges are concentrated to permit smaller fermenters and are then fermented rapidly and efficiently under membrane control. All the undesirable by-products are converted into useful chemicals such as liquid ammonia and organic acids. This is followed by a secondary aerobic fermentation to obtain the virtually complete destruction or conversion of all organic matter to chemical by-products. This system is highly compact and capable of being placed into operation at sewage treatment plants to effect a virtually closed-loop operation.
W86-00361

MARKET ASSESSMENT AND TECHNOLOGICAL EVALUATION OF THE CPU-4000 CHEMICAL PRECIPITATION UNIT,
Battelle Columbus Labs., OH.
J. L. Means, N. D. Gregorich, and E. W. Helper.
Final Report, October 25, 1983. 33 p, 1 Fig, 8 Tab, 26 Ref, Append.

Descriptors: *Heavy metals, *Metal-finishing wastes, *Separation techniques, *Chemical precipitation, *Wastewater treatment, Marketing, Effluent limitations, *Industrial wastewater, Industrial wastes, Metals, Comparison studies.

A market assessment of the CPU-4000, a device which can be used as a pollution control mechanism for heavy metals in industrial effluents is given along with a comparison of CPU-4000 technology with that of other metal removal techniques. A target market for the CPU-4000 ranging from 23,828 to 23,891 firms was identified. In the metal finishing industry, 5,060 markets are identified; and in the photofinishing industry, 5,500 markets are attributed to hospitals and 9,801 markets are attributed to graphic art firms. Photographic processing accounts for 1,667-1,730 markets for CPU-4000 technology while non-destructive testing, used in such industries as aerospace, oil pipelines, and nuclear science accounts for 1,800 markets. EPA discharge regulations for the electroplating and metal finishing industries limit cyanide, Pb, Cd, Cu, Ni, Cr, Zn and Ag for plants with a daily flow of 38,000 liters and Pb, Cd, and cyanide for plants with a daily flow of < 38,000 liters. The sodium sulfide precipitation technique is considered extremely effective for treating wastewater containing toxic metal ions. The CPU-4000 which embodies the sodium sulfide precipitation technique can remove up to 30 different metal ions whereas electrolytic deposition, metallic replacement and ion exchange are generally effective in removing only a single metal ion.
W86-00386

DIGESTION OF FORMALDEHYDE BY ADAPTED BACTERIA (ZUM ABBAU VON FORMALDEHYD DURCH ADAPTIERTE BAKTERIEN),
Karl-Marx-Univ., Leipzig (German D.R.). Sektion Biowissenschaften.
U. Behrens, and J. Hannes.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 39-45, 1984. 3 Fig, 18 Ref.

Descriptors: *Formaldehyde, *Biological wastewater treatment, *Bacteria, Wastewater treatment, Activated sludge process.

Municipal activated sludge was cultivated in a medium composed of formaldehyde, glucose and mineral salts. By passages with increasing formaldehyde concentrations, a bacterial culture was selected which remained active at initial concentrations of 1 g/l formaldehyde. With this culture, formaldehyde and glucose were oxidized simultaneously to formate and gluconate, which subsequently served as substrate for the growth of bacteria. Glucose alone was also oxidized to gluconate, which then was used as substrate for growth. Formaldehyde alone was only oxidized. If the actual formaldehyde concentration was kept low, however, by fed-batch cultivation, it was assimilated through formate formation. The biochemical background and the importance of the findings for the purification of formaldehyde-containing wastewaters are discussed. (Author's abstract)
W86-00397

OCCURRENCE OF R-PLASMIDS IN ESCHERICHIA COLI AND COLIFORM GERMS FROM WATER AND WASTEWATER; PART 2: METHODS OF ISOLATION OF R+ -BACTERIA FROM SURFACE AND WASTEWATER, THE

TRANSFER OF THEIR R-PLASMIDS AS WELL AS THE DETERMINATION OF THE RESISTANCE IMAGES (UBER DAS VORKOMMEN VON R-PLASMIDEN IN ESCHERICHIA COLI UND KOLIFORMEN KEIMEN AUS WASSER UND ABWASSER; TEIL 2: METHODEN DER ISOLIERUNG VON R+ - BACTERIEN AUS OBERFLACHEN - UND ABWASSER, DES TRANSFERS IHRER R-PLASMIDE SOWIE DIE BESTIMMUNG DER RESISTENZ-BILDER),
Institut fur Experimentelle Epidemiologie, Wernigerode.
H. Heier, and H. Tschape.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 47-54, 1984. 4 Tab, 14 Ref.

Descriptors: *Escherichia, *Coliforms, *Plasmids, *Wastewater, *Surface waters, Bacteria, Hospitals, Antibiotic resistance, Municipal wastewater, Effluents, Wastewater treatment facilities.

A detailed description is given of methods for the isolation of R+ bacteria from water and wastewater, the determination of their resistance pattern and the transfer of R-plasmids from wild strains to Escherichia coli K 12. Results are given of investigations on the inflows and outflows of municipal and rural clarification plants as well as of a special hospital for lung-diseases and a urological clinic. It was found that coliform bacteria with a threefold and fourfold resistance were dominant in wastewater and surface water and that there was a pronounced shift to strains with a multiple resistance in hospital sewage. The values for the quotient of the single resistance in coliform germs from the wastewater of a lung-disease sanatorium and of germs with multiple resistance in the wastewater from an urological clinic were particularly high. As can be demonstrated, the selective pressure of the different chemotherapeutic agents used for the therapy is effective. (Author's abstract)
W86-00398

ELIMINATION AND RECOVERY OF METAL IONS FROM WASTEWATER - A SURVEY (ELIMINIERUNG UND RUCKGEWINNUNG VON METALLIONEN AUS ABWASSERN - EINE UBERSICHT),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
R. Kummel, F. Winkler, and R. Beck.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 3, p 227-237, 1984. 6 Fig, 16 Ref.

Descriptors: *Heavy metals, *Wastewater treatment, Metals, Ion exchange, Recycling, Membrane processes, Chemical treatment, Ultrafiltration.

The present state and the trends in the recovery of heavy metals from wastewaters are presented. The classical precipitation techniques are unsatisfactory due to increases in solubility in the presence of impurity ions and/or complexing agents. At present, ion-exchange processes constitute the most frequently used method of metal recycling with an effective enrichment of metal ions. For the effective separation of metals from solutions of a low concentration, electrolytic reduction demands large electrode surface areas. In cells with fixed-bed or fluidized cathodes one can obtain specific electrode surface areas of some 1000 sq m/cu m. For the future, processes of extraction and especially membrane separation will gain in importance. In the past few years, a large number of highly selective metal extracting agents as well as liquid membrane permeation with suitable carriers were developed. Combinations of membrane separation processes with chemical reactions may attain the same importance, as e.g. ultrafiltration in connection with the fixation of metal ions to water-soluble polymers. In the long run, techniques will prevail which will not only result in metal enrichment but also in the recovery of the raw material water. (Author's abstract)
W86-00410

POSSIBILITIES OF THE CORRELATION OF DIFFERENT WATER ANALYSIS METHODS (MOGLICHKEITEN DER KORRELATION UNTERSCHIEDLICHER WASSERANALYSEN-VERFAHREN),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
For primary bibliographic entry see Field 5A.
W86-00411

POSSIBILITIES OF THE AFTERPURIFICATION OF WASTEWATERS FROM THE PRODUCTION OF ARTIFICIAL LEATHER WITH THE AID OF ALGAE. PART 2 (MOGLICHKEITEN DER NACHREINIGUNG VON ABWASSERN AUS DER KUNSTLEDERPRODUKTION MIT HILFE VON ALGEN, TEIL 2),
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. Chromek, J. Kupec, P. Marvan, and M. Mladek.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 521-530, 1984. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Biological wastewater treatment, *Industrial wastewater, *Algae, *Artificial leather industry, Wastewater treatment, Dimethylamine, Phosphorus, Nitrogen, Scenedesmus.

An attempt was made to use the alga Scenedesmus quadricauda for the purification of wastewaters from the production of artificial leather. The dimethylamine contained in these wastewaters is continuously decomposed and the remaining nitrogen-containing residuals are used as a nutrient source for the production of algal biomass. In continuous experiments with wastewaters, dimethylamine and its metabolites showed a pronounced inhibiting effect. In practice, a longer retention time in the reactors as well as a sufficient proportion of municipal wastewater are required in order to avoid a limiting of growth due to a phosphorus deficiency. Information is given on other investigations performed on the purification of artificial leather wastewaters with the aid of the biological nitrogen elimination under specific conditions with a successful denitrification of up to 95%. (Author's abstract)
W86-00418

MIXING CHARACTERISTICS AND PERFORMANCE OF THE ANAEROBIC UPFLOW BLANKET FILTER (UBF) REACTOR,
Biotechnology Research Inst., Ottawa (Ontario).
R. Samson, and S. Guiot.
Journal of Chemical Technology and Biotechnology, Vol. 35B, No. 1, p 65-74, March, 1985. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Upflow blanket filter, *Mixing, *Wastewater treatment, Chemical oxygen demand, Filtration, Anaerobic digestion, Biological wastewater treatment.

Mixing characteristics (using a radioactive tracer) and reactor performance of the upflow blanket filter (UBF) reactor operated at different loading rates (up to 32 kg chemical oxygen demand (COD)/cu m/day) were compared. The results indicated that mixing profiles of the reactor operated with effluent recirculation and without biomass were of the perfectly mixed type. Operation without recirculation resulted in about 18% dead space. The filter made of plastic rings and located in the top third of the reactor had no negative effect on reactor mixing. Operation at loading rates of up to 25 kg COD/cu m/day permitted a soluble COD removal rate of 95% with a methane production rate of 5.9 cu m/cu m/day. At higher loading rates, the efficiency of COD reduction decreased with a decrease of the specific acetoclastic activity to 0.5 kg acetate removed per kg volatile suspended solids (VSS)/day. At all loading rates studied it was observed that the performance was not related to the mixing characteristics, which had remained of the perfectly mixed type with an occasional small dead space (below 10%). The good mixing characteristics of the UBF reactor coupled with the high biomass content and the effective action of the filter make this reactor one of the most promising designs for the treatment of soluble wastes. (Author's abstract)
W86-00423

ALGAL-BIOMASS RACEWAY SYSTEM FOR PARTIALLY TREATED SWINE WASTEWATER IN THE TROPICS,
Hawaii Univ. at Manoa, Honolulu. Dept. of Agricultural Engineering.
P. Y. Yang, and S. Y. Nagano.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 2, p 542-546, March/April, 1985. 4 Fig, 6 Tab, 16 Ref.

Descriptors: *Wastewater treatment, *Animal wastes, *Algal-biomass raceway system, Tropical regions, Farm wastes, Ammonia, Biochemical oxygen demand.

The algal-biomass raceway system for growth of mixed algae and bacteria from anaerobically digested effluent and settled supernatant of raw swine wastewater was compared with three other stabilization processes on the basis of BOD5 loading rates, percent removal efficiency and energy consumption of kilowatt hour input per Kg removal of BOD5. The four aerobic systems were oxidation ditch, algal-biomass raceway, facultative oxidation pond, and aerated lagoon. The oxidation ditch and algal-biomass raceway accommodate much higher BOD5 loading rates than either the facultative oxidation pond or aerated lagoon. Overall removal efficiencies were generally good for all four systems. The algal-biomass system most closely resembles the aerated lagoon in removing BOD5 since both have similar energy consumption values. The main advantage of the algal biomass system over the aerated lagoon system is the nearly three-fold higher BOD5 loading rate that can be used. Another advantage of using algal-biomass systems is in removing NH4-N. Its removing efficiency is 65.8% at a loading rate of 0.029 g/L/day. Its removal efficiency is within the range of 40-80% reported for the oxidation ditch and slightly higher than the 60% of the aerated lagoon. In addition, the algal-biomass raceway system provides a lower land requirement for treatment, except for the oxidation ditch. The algal-biomass raceway can handle almost three times the BOD5 loading rate applied to the aerated lagoon, yet uses only two-thirds the land area. (Baker-IVI)
W86-00482

STUDIES OF THE HYDRODYNAMIC PROPERTIES IN BIOLOGICAL CLARIFICATION PLANTS USING RADIOTRACERS,
Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung.
H. G. Koennecke, D. Luther, K. Koepping, J. Schoen, and H. Ulrich.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 431-434, 1984. 5 Fig, 6 Ref.

Descriptors: *Biological wastewater treatment, *Hydrodynamics, *Radioactive tracers, Wastewater treatment, Bromine radioisotopes, Activated sludge process, Optimization, Mathematical studies.

Employment of Br-82 as a tracer, combined with mathematical analysis of results, was used to optimize performance of two sewage treatment plants in the German Democratic Republic. The first plant studied involved two pools, of which the first, an activated sludge chamber with an aeration impeller, a volume of 7,670 cu m, and a inflow of 730 cu m per hr, was analyzed. The second plant had a throughput of 100,000 cu m per day, and comprised 8 activated sludge chambers of 4,000 cu m volume each. Aeration in the second plant was accomplished by tubes placed side-by-side, 70 cm apart, in the activated sludge chambers. Pool I was shown to be an ideal mixing reactor based on the equation c=c sub 0 . e (-/MRT), in which c sub 0 = initial concentration and MRT = mean residence time. Reversing the impeller's direction of rotation induced a reduction of the by-pass flow of 50%, resulting in improved efficiency in the activated sludge chamber. In plant II, MRT during maximal throughput (625 cu m per hr in each activated sludge chamber) is 374 min, but is only 355 min during minimal throughput (125 cu m per hr). Neither by-pass flow nor wake space were found. MRT was abnormal with respect to

throughput in this chamber, so that the regeneration volume in the chamber will be used for degradation of the contents of the sewage during minimal throughput. Movement of the sewage inlet to the front side of the chamber results in a 20% increase in throughput, with a resulting energy saving of 3.5 x 1,000,000 kWhr/a. (Rochester-IVI)
W86-00543

MODEL OF A BACTERIAL CULTURE UTILIZING A TOXIC SUBSTRATE IN CONTINUOUS FLOW CONDITIONS,
Bulgarian Academy of Sciences, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika.
For primary bibliographic entry see Field 5B.
W86-00549

EPA DEBATES SWITCH FROM THE CARROT TO THE STICK IN SEWAGE TREATMENT,
R. L. Stanfield.
National Journal, Vol. 17, No. 6, p 312-316, February, 1985.

Descriptors: *Wastewater treatment facilities, *Legislation, Funding, Construction, Water pollution control, Loans, Grants, Pretreatment, Urban areas.

In 1985, Congress must determine the federal government's role in water treatment when the federal program that presently contributes a large fraction of the money for treatment plant construction expires on September 30. Originally, the law offered funds to municipalities to help with construction of plants as a way to gain their cooperation in compliance. Great strides have been made since the 1960's in cleaning up household and commercial wastes, particularly in small localities. From 1970, before the federal grant program was started, to 1982, however, the contribution of municipalities and states for wastewater projects has dropped from $2.3 billion to less than $1 billion for projects that received no federal aid. Bills are before Congress to hold the federal contribution for construction to the present $2.4 billion annually or to increase the size of the program. Another idea is to convert the program from grants to a revolving loan program. Large cities, which have not benefitted as much as smaller ones under the existing program because of the difficulties of getting started on larger projects, now complain that the program should not be cut back just when they are ready to begin construction. An additional problem to be faced is what to do about toxic discharges, which originate largely in industry and were not considered an issue when the original Clean Water Act facilities grants program was designed. Some cities wish to opt out of the present federal pretreatment program, which is just now getting underway, and create their own programs based on performance criteria rather than the Environmental Protection Agency's (EPA) 'best available technology' approach. Failure of many cities to submit pretreatment plans on time has necessitated an increase in EPA enforcement activity. (Rochester-IVI)
W86-00559

5F. Water Treatment and Quality Alteration

ION-SELECTIVE ELECTRODES (ISE) - RESEARCH INTO THE POTENTIAL REGULATION AND APPLICATION IN ANALYSIS (IONENSELEKTIVE ELEKTRODEN (ISE) - UNTERSUCHUNGEN ZUR POTENTIALEINSTELLUNG UND ANWENDUNG IN DER ANALYTIK),
Technische Hochschule 'Carl Schorlemmer' Leuna-Merseburg (German D.R.).
For primary bibliographic entry see Field 5A.
W86-00395

PHYSICO-CHEMICAL CHARACTERISTICS OF THE USED FILTER SAND AND ITS ROLE IN THE SEVEN WATER WORKS SYSTEM IN A TROPICAL REGION,
Bhopal Univ. (India). School of Biological Science.
D. Y. Prasad, and D. K. Belsare.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 1, p 73-80, 1984. 5 Tab, 8 Ref.

Descriptors: *Water treatment, *Sand filters, *Tropical regions, India, Filters, Particle size, Backwash, Filter regeneration.

The filter-technique equipment of seven water works in a tropical region of India is described. The structure of the filter sand layer, the grain size distribution and the degree of uniformity are compared by means of tables. The uniformity coefficient of a good filter sand is smaller than 1.7. Besides physical properties, also the surface properties of the filter sand grains are of interest. Different analytical methods for determining the incrustation are described. The amount of the filter grain load also depends on age, that is, on the service life of the filter sand. The efficiency of a filter plant is determined also by the regenerating process, that is, by back-wash. This includes the methods of scouring with water only and the backwashing with water/air. In order to remove organic and inorganic matter that might form a coating on sand, it is necessary to drain the filter to rake them and to expose them to dryness once a fortnight. Then they should be immediately washed to get rid of fine dirt. Similarly, each filter should be superchlorinated for one hour. The top layer of sand (15 cm) may be washed in a Nicholds sand washer. Investigations are necessary under tropical conditions to find out the best working system from all points of view. (Baker-IVI)
W86-00399

WATER CHEMISTRY AND MATERIALS ECONOMY (WASSERCHEMIE UND STOFFWIRTSCHAFT),
Technische Univ., Dresden (German D.R.). Sektion Verabeitungs- und Verfahrenstechnik.
M. Schubert, and J. Kaeding.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 117-120, 1984. 1 Ref.

Descriptors: *Water chemistry, *Water quality, Drinking water, Water treatment, Economic aspects, Environmental effects, Energy, Industrial water, Irrigation water.

For solving of the most important problems concerning water quality economy, drinking water supply, industrial water and irrigation water without hazardous or otherwise detrimental substances the available findings and results of specialized research in water chemistry are needed. In the logical continuation of the development to the level necessary for practical application, the experts in the engineering disciplines have to be consulted. The design of the sequence of water treatment processes depends on the aims of the tasks set, and questions are increasingly being raised concerning the possibilities of saving and recovery of energy and raw materials. In the area of production, in the interest of environment protection one already endeavours to achieve a direct or indirect low-waste or non-waste process design. Finally, possibilities of materials and power economy are discussed using the examples of treatment of chemical industry wastewaters and municipal wastewaters. (Author's abstract)
W86-00402

MOLECULAR MASS DISTRIBUTION OF ORGANIC SUBSTANCES IN THE DRINKING WATER OF PRAGUE (MOLMASSEVERTEILUNG DER ORGANISCHEN STOFFE IM PRAGER TRINKWASSER),
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Lehrstuhl fuer Wassertechnolgie und Umweltschutz.
P. Lischke, and J. Chudoba.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 121-129, 1984. 1 Fig, 4 Tab.

Descriptors: *Drinking water, *Organic matter, *Prague, *Czechoslovakia, Jizera, Vltava, Zelivka, Water quality, Gel chromatography, Chemical oxygen demand, Flocculation, Water treatment, Organic carbon.

The water supply of Prague (Czechoslovakia) is based upon three different water resources: artesian groundwater and infiltrate of the Jizera river, water of the Vltava and Zelivka rivers. The processing techniques are different; consequently for the purpose of increasing capacity one has to search for the suitable raw water quality as well as for the optimum treatment process. An essential parameter for this is the contents of organic substances whose mass distribution is investigated by gel chromatography with the aid of Sephadex G-10, G-25 and G-50. With respect to the total load of organic matter the Jizera shows the lowest values, in the Vltava the C.O.D. values are the highest, in the Zelivka the organic carbon shows the highest values. 80% of the organic substances in water have molar masses below 700. By flocculation 60-70% of the C.O.D.-Cr can be eliminated, the optimum removal of the high-molecular substances occurring at pH = 6 and with 50-60 g/cu m aluminium sulfate. (Author's abstract)
W86-00403

CAPACITY OF MACROPOROUS ADSORBER POLYMERS IN THE ELIMINATION OF ORGANIC MICROCONTAMINANTS (ZUM LEISTUNGSVERMOGEN MAKROPOROSER ADSORBERPOLYMERE BEI DER ELIMINATION ORGANISCHER MIKROVERUNREINIGUNGEN),
Technische Univ., Dresden (German D.R.). Sektion Wasserwesen.
H. J. Walther, J. Kaeding, and P. Fechner.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 2, p 173-181, 1984. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Organic compounds, *Adsorption, *Polymers, *Water treatment, Adsorbents, Filtration, Activated carbon, Desorption.

In laboratory experiments the adsorption of eleven different organic substances in water was individually tested in the range of concentration of 0.2-5.0 mg/l on EP 60 and EP 61 (styrene-divinylbenzene, non-polar) and EP 62 and Y 59 (acrylic-acid-ester-divinylbenzene, polar). In batch experiments the elimination at 1-2 g/l adsorber quantity was 35-80%, strongly dissociated anionic substances such as benzoic acid being adsorbed only to a low degree and weakly cationic and undissociated substances being adsorbed well. Within a homologous series, adsorption increases with the molar mass until the pore diameter became too small for the up-take of substances. Under dynamic conditions (filtration technology) an elimination of 90-100% can be expected. As a whole, the adsorption on activated carbon was better in all cases than the adsorption on the polymers. The desorption for the regeneration of the polymers is more difficult the better the substance contained is adsorbed. By repeated loading and regeneration only a slight influence on the adsorption and desorption of a substance was found. (Author's abstract)
W86-00409

DISINFECTION OF DRINKING WATER - A CRITICAL REVIEW (DIE DESINFEKTION VON TRINKWASSER - EIN KRITISCHER UBERBLICK),
Bremer Umweltinstitut fuer die Analyse und Bewertung von Schadstoffen (Germany, F.R.).
B. Stachel, B. Gabel, U. Lahl, and B. Zeschmar.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 499-519, 1984. 4 Fig, 10 Tab, 119 Ref.

Descriptors: *Disinfection, *Drinking water, *Reviews, Chlorination, Trihalomethanes, Chlorine dioxide, Halogenated hydrocarbons, Chloramine, Ozone, Ultraviolet radiation, Water treatment.

In drinking water chlorination about 90% of the chlorine shows an oxidizing effect, 10% results in halogenated reaction products, and ca. 1% results in trihalomethanes. When chlorine dioxide is applied, the trihalomethanes remain below the detection limit, but increasingly polar organic reaction products originate. Chloramine is rarely applied, mostly for storage reservoir waters. Little information about reaction products is available. With the application of ozone one obtains a wide spectrum

of reaction products; the aldehyde contents can be influenced by activated carbon. Especially critical is the formation of persistent epoxides, especially from pesticides. Ultraviolet irradiation is gaining in interest, and in many cases its biocidal effect is superior to that produced by chlorination and ozonation, except for the problem of re-germination in the water supply network. The costs of ultraviolet irradiation are much higher than those of the other techniques; chlorination costs only about one quarter as much as the other chemical disinfection techniques. (Author's abstract)
W86-00417

POTENTIOMETRIC FLUORIDE DETERMINATION IN DRINKING WATER (POTENTIOMETRISCHE FLUORIDBESTIMMUNG IN TRINKWASSER),
Bezirks-Hygieneinspektion und -Inst. Cottbus (German D.R.).
K. Seifert, and W. Klaue.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 377-382, 1984. 4 Tab, 5 Ref.

Descriptors: *Fluorides, *Drinking water, *Potentiometry, Water analysis, Interference.

The measurement is carried out after addition of perchloric acid up to a concentration of 0.45 M perchloric acid, and the results are compared with those obtained in 0.16 M sodium citrate as well as with a gas-chromatographic determination, and they show a good agreement. The detection limit is 0.002 mg/l F(-), the coefficient of variation is nearly 0.01 at 0.85 mg/l F-, independently of whether a direct measurement or a measurement with a standard addition is carried out. The measurement is disturbed by aluminium (III)- and iron(III)-ions. (Author's abstract)
W86-00539

DIURNAL THERMAL STRATIFICATION AND FLOC RISING IN CLARIFLOCCULATORS OF THE TROPICAL WATER WORKS,
Bhopal Univ. (India). School of Biological Science.
D. K. Belsare, and D. Y. Prasad.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 4, p 393-398, 1984. 1 Fig, 4 Tab, 4 Ref.

Descriptors: *Flocculation, *Tropical regions, *Thermal stratification, *Water treatment, *Floc rising, Filtration, Aeration, Supersaturation, Dissolved oxygen, Photosynthesis, Phytoplankton.

Water treatment facilities in tropical areas may have difficulties caused by floc rising; the flocs pass on to the rapid sand filters and reduce the filter run. Floc rising occurring during the day-hours (especially in the hot season) in the flocculators was investigated at four tropical water works. This phenomenon is caused by the great heating of the raw water during the daytime. Between 10.00 a.m. and 10.00 p.m., a temperature difference up to 3.7 K between the influent and the effluent of the flocculators occurs during a retention period of 3.5-5 h within the flocculators. Every temperature differences of only 1 K result in floc rising, reducing the filter run by four to seven hours. Oversaturation of the raw water with oxygen by the photosynthetic oxygen production constitutes an additional cause. The aeration of the water at the raw water intake point is recommended to prevent a thermal stratification during the day-hours and at the same time to remove the oxygen oversaturation. The phytoplankton population should also be kept at an optimum level to reduce floc rising. (Moore-IVI)
W86-00541

NITRATE IN DRINKING WATER - PROBLEMS OF HYGIENE AND TREATMENT (NITRAT IM TRINKWASSER - HYGIENISCHE UND AUFBEREITUNGSTECHNISCHE),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
J. Putzien.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 6, p 577-593, 1984. 12 Fig, 3 Tab, 14 Ref.

Descriptors: *Nitrates, *Drinking water, *Water treatment, Groundwater pollution, Methemoglobinemia, Carcinogens, Teratogens, Mutagens, Ion exchange, Reverse osmosis, Electrodialysis, Denitrification.

The increasing nitrate concentrations in the ground water and drinking water which are caused by intensified fertilizing lead to the risk of methemoglobinemia of babies and increase the cancerogenic, teratogenic and mutagenic risk for the total population. In the drinking water conditioning the nitrate concentration can be reduced by different techniques. By ion exchange first the SO4-ions and then the nitrate-ions are removed. The exchange is very favorable for HCO3(-) and the regeneration by means of carbon dioxide and CaCO3, for which a mass balance of substances is given. With 0.55 DM/cu m also the reverse osmosis in a mixture with raw water is practicable and also electrodialysis can be applied, whereas the biological techniques of the heterotrophic or autotrophic denitrification still include unsolved technological problems due to the necessity of an organic substrate or of H2. The special features of each of these techniques and the hygienic and also the corrosion-chemical consequences are indicated. (Author's abstract)
W86-00545

5G. Water Quality Control

ENVIRONMENTAL ASPECTS OF ARTIFICIAL AERATION AND OXYGENATION OF RESERVOIRS: A REVIEW OF THEORY, TECHNIQUES, AND EXPERIENCES,
Tetra Tech, Inc., Bellevue, WA.
R. A. Pastorok, M. W. Lorenzen, and T. C. Ginn.
Technical Report E-82-3, May 1982. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 277 p, 26 Fig, 21 Tab, 327 Ref, Append.

Descriptors: *Water quality control, *Aeration, *Reservoirs, *Lakes, *Water circulation, *Destratification, *Mixing, Hypolimnion, Reservoir releases, Outlets, Tailwater, Oxygenation, Pumps, Aquatic life, Algae, Phytoplankton, Biomass, Fish, Zooplankton, Eutrophication, Stratification, Thermal stratification.

This report includes (1) a literature review of aeration/circulation techniques for reservoirs, (2) a statistical analysis of alternative artificial circulation methods, (3) morphometric and water quality data for 107 reservoirs, and (4) an evaluation procedure for alternative management applications in reservoirs. Artifical destratification usually elevates dissolved oxygen levels in a lake by bringing anoxic bottom waters to the surface for aeration from the atmosphere. Oxygenation may precipitate phosphates and inhibit nutrient release from sediments, which may be counteracted by invertebrate activity. If pumps are undersized or destratification is untimely with respect to algal blooms, oxygen deficits can be aggravated. Mixing at the surface usually reduces algal biomass per unit area of lake surface, lowers the pH in the upper waters, replaces blue-green algae with green algae, increases the zooplankton and benthic macroinvertebrate populations, and produces short-term increases in fish growth and yield. Hypolimnetic aeration improves water quality without disrupting thermal stratification. Although hypolimmetic aeration has limited effect on algal blooms, the risk of adverse effects is lower. Oxygenation of downstream reaches can be accomplished by hypolimnetic aeration, localized mixing, aeration in the outlet works, and tailwaters aeration.
W86-00327

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN: DRAFT RESPONSE AND INCIDENT TRACKING PROCEDURES.
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-116087. Report MI/DNR/GW-82/05, July 1982. Tasks 6 and 3. 13 p. 3 Fig. Contract/Grant No. P00558801.

Descriptors: *Groundwater, *Groundwater management, *Groundwater pollution, Water quality, Resource management, Water pollution control, Regulations, *Michigan.

Several management tools are needed to guide state response to incidents of groundwater pollution because of the large number of incidents at which state response actions may need to be performed. Two primary management tools for Michigan are described in this document. These management tools are: (1) General Response Procedures, guidance as to how and when state actions are initiated in response to incidents of groundwater pollution concern; and (2) Incident Tracking Procedures, and information management system to facilitate the recording, tracking and distribution of information on the status of each contamination incident. Draft Response and Incident Tracking procedures are presented and will be further refined as the project proceeds.
W86-00362

IMPACT OF THE SILVER CARP (HYPOPHTHALMICHTHYS MOLITRIX VAL.) ON THE ECOSYSTEM OF CARP PONDS,
Instytut Rybactwa Srodladowego, Piaseczno (Poland). Dept. of Pond Management.
For primary bibliographic entry see Field 5B.
W86-00439

CHESAPEAKE BAY: SAVING A NATIONAL RESOURCE THROUGH MULTI-STATE COOPERATION,
Bureau of National Affairs, Inc., Washington, DC.
Dept. of Environment, Safety and Health Services.
For primary bibliographic entry see Field 6E.
W86-00572

POINT SOURCE WATER QUALITY CONTROL IN VIRGINIA: CHOICES FOR THE CHESAPEAKE,
Chesapeake Bay Foundation, Inc., Richmond, VA.
J. M. Watson.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 263-300, 1985. 203 Ref.

Descriptors: *Water pollution control, *Water quality control, *Chesapeake Bay, *Virginia, Governmental interrelations, Wastewater treatment, Nutrients, Water quality standards.

Water quality degradation in the Chesapeake Bay, early judicial attempts to remedy water quality damage in Virginia, state legislative approaches to water quality protection, federal water quality legislation, Virginia's water quality control program and legal challenges to its implementation, and the Virginia Chesapeake Bay initiatives are reviewed, and recommendations are made that would help retard the deterioration of the Bay. Emphasis is placed on point sources of pollution. Two divergent policy trends are apparent: (1) the recognition by the Environmental Protection Agency (EPA) of the need for advanced wastewater treatment for nutrients and toxic substances, particularly in the James River and Hampton Roads areas, which implies technology forcing standards and limitations, and (2) the Virginia Supreme Court's limitation of the State Water Control Board exclusively to the enforcement of standards and limitations that can be met with existing technology. Furthermore, the State Water Control Board, after initial efforts in several areas, has largely abandoned addressing nutrient problems through the National Pollution Discharge Elimination System program. Recent cooperative efforts among jurisdictions surrounding the Bay, in response to the EPA Chesapeake Bay program study, make now a good time for renewed attempts to control pollution. The Virginia Chesapeake Bay initiatives may not be able to be meaningfully implemented, however, until the Virginia General Assembly moves to reverse the holding in the County Utilities case, which limits action to available technology, thus not allowing technology forcing. In addition, funding of programs should be increased for efforts to

clean up the Bay, and day-to-day activities of enforcement, maintenance, repair, personnel training, and continued research and application should be continued. (Rochester-IVI)
W86-00575

6. WATER RESOURCES PLANNING

6B. Evaluation Process

RIPARIAN AND STREAM ENHANCEMENT MANAGEMENT AND RESEARCH IN THE ROCKY MOUNTAINS,
Intermountain Forest and Range Experiment Station, Boise, ID.
W. S. Platts, and J. N. Rinne.
North American Journal of Fisheries Management, Vol. 5, No. 2A, p 115-125, Spring, 1985. 1 Fig, 1 Tab, 71 Ref.

Descriptors: *Riparian waters, *Rocky Mountains, *Stream enhancement, Management, Streams, Water management, Planning, Land use, Streambanks, Vegetation, Aquatic animals.

The most important research efforts conducted to date are reviewed and evaluated concerning their adequacy and effectiveness of future stream enhancement projects. The available research results also are stratified by components that comprise the aquatic habitat: riparian, water column, stream bank, channel, and biotic. The importance of riparian ecosystems was first addressed seriously in the late 1970's. Because riparian vegetation responds quickly to changes in management, in many cases restoration can be made to damaged riparian habitats with the time required depending on climatic conditions, soil fertility and surrounding land use. Reports are discussed which touch on the following areas of interest: importance of vegetation in riparian areas, fencing riparian areas, stream rehabilitation (with emphasis on water column, and channel characteristics), rehabilitating aquatic biota (threatened and endangered fish, nonthreatened fish, and macroinvertebrates), and proposals for sensible stream research and enhancement. Most watershed research has been oriented toward the production of specific products such as forage, meat, timber, and minerals. Such research has usually been aimed at evaluating the impacts of commodity production on other values such as fishing. Research aimed at mitigating or rehabilitating degraded aquatic environments needs special attention in the next decade. Emphasis should be placed on determining how to incorporate compatible grazing strategies into land management, conducting long term studies on stream enhancement structures to determine success, proper location, and adaptability to the different stream conditions, and conducting studies to better understand how enhancement projects affect fish communities and their environments. (Baker-IVI)
W86-00588

6D. Water Demand

WATER SUPPLY STUDY: SACO AND SOUTHERN MAINE RIVER BASINS.
Sverdrup and Parcel and Associates, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA 120116. Corps of Engineers Water Supply Study, March 1982. 64 p. 16 Tab, 2 Maps, 14 Ref. Contract/Grant No. DACW33-80-C-0085.

Descriptors: *Water demand, *Water supply, *Water resources development, *Water scarcity, Water conservation, Groundwater availability, Groundwater, Maine, Planning.

Several very serious deficiencies of water supply have been identified in the southern Maine coastal area, specifically the seven communities of Kittery, Eliot, York, Wells, Kennebunk, Arundel and Kennebunkport. There are problems meeting both peak seasonal demand and peak daily demands. A short-term solution to these peak deficits can be achieved in most cases through the use of equalizing storage facilities, peak pricing and regulation measures. Long-term demand projected to the year 2030 can be met by combination of conservation and increased use of Saco River water. There is a danger of future contamination of the upper Saco River that is currently being examined by the states of Maine and New Hampshire.
W86-00371

ISSUES IN THE JAMES RIVER CORRIDOR,
Richmond Regional Planning District Commission, VA.
For primary bibliographic entry see Field 6G.
W86-00582

6E. Water Law and Institutions

MAJOR PROJECT IN THE AGE OF THE ENVIRONMENT: OUT OF CONTROVERSY, COMPLEXITY, AND CHALLENGE,
Corps of Engineers, Mobile, AL. Mobile District.
N. D. McClure, IV.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 15-24, 1985. 2 Tab, 17 Ref.

Descriptors: *Water resources development, *Tennessee-Tombigbee Waterway, *Environmental effects, *Legal aspects, Regulations, Planning, Waterways, Construction.

Throughout its development, the Tennessee-Tombigbee Waterway (Tenn-Tom) has experienced a turbulent existence. It has been subjected to considerable scrutiny from all three branches of the federal government. Central among these challenges was the litigation involving allegations under the National Environmental Policy Act. Environmental issues and controversies related to the Tenn-Tom included the following: hydrogeology; basin connection and water transfer; water quality; sedimentation and erosion; change of free flowing streams to impoundments; disposal of excavated material; loss of wildlife habitat; cultural resources; navigation impacts; and indirect impacts such as induced land use changes and alterations to the socioeconoic situation. (Baker-IVI)
W86-00333

EPA DEBATES SWITCH FROM THE CARROT TO THE STICK IN SEWAGE TREATMENT,
For primary bibliographic entry see Field 5D.
W86-00559

INDIAN ALLOTMENT WATER RIGHTS,
Colorado Univ. at Boulder. School of Law.
R. B. Collins.
Land and Water Law Review, Vol. 20, No. 2, p 421-457, 1985. 180 Ref.

Descriptors: *Indian rights, *Water rights, *Tribal lands, Native Americans, Legal aspects, Indian reservations, Federal jurisdiction, State jurisdiction.

Allotted tribal lands create troublesome questions for western water lawyers. In this article the author reviews the history of basic Indian reservation water rights created by the Supreme Court's landmark decision in Winters v. United States. The disposition of those rights when reservation lands are allotted are then explained. Finally, the difficult issues that arise when allotted lands pass from the federal trust, become subject to state law, and are transferred to non-Indians, are discussed. (Author's abstract)
W86-00560

FORFEITURE PROCEEDINGS IN WYOMING WATER LAW: THE LEGISLATURE REVIVES PRIVATE STANDING,
E. W. Harris.
Land and Water Law Review, Vol. 20, No. 2, p 459-474, 1985. 113 Ref.

Descriptors: *Wyoming, *Water rights, *Private standing, *Forfeiture, Prior appropriation, Beneficial use, Legal aspects, Standing.

Wyoming water law, like much of that in the United States, was based initially on a simple prior appropriation concept: those who put water to beneficial use first were entitled to its use. This provided security for investors and encouraged the most productive economic use, thus benefitting society in general. State administration improved this pioneer concept by adding an orderly way to keep track of dates of appropriation and to recognize challenges to others' water rights. Water rights that are forfeited return to state ownership, and can thus be appropriated by someone else. Prior to 1984, standing to bring forfeiture proceedings was gained merely by showing that the plaintiff was 'affected' within the meaning of the forfeiture statute. In 1984 the Wyoming Supreme Court in Cremer versus State Board of Control appeared to change the definition of standing. In the decision in Platte County Grazing Association versus State Board of Control, the Court made it clear that the junior appropriator had to show injury to have standing to attack a senior's rights. This decision represented a major change in Wyoming water law that did not conform to precedent. The Wyoming Legislature in 1985 amended the forfeiture statute to grant standing to make it clear that 'affected' in the law meant either benefitted or injured, not just the latter, as the Court had held. (Rochester-IVI)
W86-00561

SIXTH CIRCUIT'S UNSETTLING INTERPRETATION OF THE CORPS OF ENGINEERS' WETLAND DEFINITION. UNITED STATES V. RIVERSIDE BAYVIEW HOMES, INC., 729 F. 2D 391 (6TH CIR. 1984), CERT. GRANTED, 53 U.S.L.W. 3597 (U.S. FEB. 19, 1985) (NO. 84-701),
K. Lamere.
Land and Water Law Review, Vol. 20, No. 2, p 475-484, 1985. 90 Ref.

Descriptors: *Wetlands, *Judicial decisions, *Riverside Bayview Homes, *Michigan, Clean Water Act, Flooding, Fill permits, Navigable waters.

Riverside Bayview Homes, Inc., of Michigan (USA) was enjoined by district court from filling an 80-acre wetland north of Detroit as a result of an enforcement proceeding filed by the Department of the Army, Corps of Engineers (Corps) in compliance with the Clean Water Act (CWA). On a second appeal, after once sending the case back to district court, the Sixth Circuit Court reversed the holding of the district court, interpreting the CWA definition of wetlands to require 'frequent flooding by water flowing from navigable waters' as defined in the Act. The court held that the definition did not cover 'inland lowlying areas such as the one in question here that sometimes become saturated with water.' The Sixth Circuit finding conflicts with those of other circuit courts, and it appears to ignore specific, clear language in the CWA, which has been steadily expanded since its passing to define wetlands more broadly. The court established a jurisdictional limitation (navigable waters) that does not appear in CWA itself, it ignored the words 'or saturated' (regardless of mechanism of inundation) that appear in the Act, it ignored the administrative record previously established in wetland cases, and it cited the taking issue involved in Kaiser Aetna versus United States, which was unjustified. The Sixth Circuit's ruling in Riverside raises questions about the Corp's wetlands definition and regulatory permitting process. The ruling contradicts both accepted congressional intent of the CWA and wetlands case law. The Supreme Court has agreed to review this decision. (Rochester-IVI)
W86-00562

VIOLATION OF NEPA ENVIRONMENTAL IMPACT STATEMENT REQUIREMENT EXCUSED BY SUBSEQUENT AGENCY CONSIDERATION OF ALTERNATIVES. FRIENDS OF THE RIVER V. FEDERAL ENERGY REGULATORY COMMISSION, 720 F.2D 93 (D.C. CIR. 1983),

E. Merila.
Land and Water Law Review, Vol. 20, No. 2, p 486-492, 1985. 56 Ref.

Descriptors: *Environmental Impact Statement, *Hydroelectric power, Calaveras County, California, Dams, Alternative planning, National Environmental Policy Act.

In the case of Friends of the River (FoR) versus Federal Energy Regulatory Commission (FERC) the United States Court of Appeals, District of Columbia Circuit, held that FERC did not violate National Environmental Policy Act (NEPA) requirements, but that a remand of the case was unnecessary because FERC had discussed the subject at issue in its response to a previous complaint. FoR originally petitioned FERC for a rehearing on the Environmental Impact Statement (EIS) prepared in support of building a dam in Calaveras County, California (USA), because the final EIS contained only two sentences on the alternative of purchasing power from other utilities, a procedure suggested by FoR in their comments on the draft EIS. In denying the request for a rehearing, FERC addressed the purchase of power in its response, but did not reopen the EIS procedure. FoR contended that FERC 'neglected its duties' under NEPA by failing to consider and present the alternative in the EIS itself. The court did not agree with the FoR contention, even though its holding clearly conflicts with NEPA's procedural commands and the policies underlying these procedures. The three cases cited by the court, Scenic Hudson Preservation Conference versus Federal Power Commission, Swinomish Tribal Community versus FERC, and Warm Springs Dam versus Gribble, did not really support the court's holding. The result contrasts with National Wildlife Federation versus Andrus, where the court held that the reasons for accepting or rejecting alternatives must be set out in the EIS, and not in papers filed with the court. The court in this case had concluded that the violations required a remand, but did not require it because the FERC submission had remedied the defects in the final EIS. This outcome is contrary to the intent of Congress in adopting NEPA, and is not supported by precedent. It indicates that an EIS can be a pro forma rationalization, rather than an important tool in an agency's decision-making process. (Rochester-IVI)
W86-00563

WHEN WATER QUANTITY REGULATION IS NOT WATER QUANTITY REGULATION. RIVERSIDE V. ANDREWS, 568 F. SUPP. 583 (D. COLO. 1983),
T. Vincelette.
Land and Water Law Review, Vol. 20, No. 2, p 523-533, 1985. 79 Ref.

Descriptors: *Riverside Irrigation District, *Colorado, *Water quality control, *Regulations, Fill permits, Dam construction, State jurisdiction, Federal jurisdiction, Environmental effects.

Riverside Irrigation District (Colorado) brought suit against the Army Corps of Engineers (Corps), claiming that the Corps lacked authority to deny a request for a dredge and fill permit for their dam project because they were entitled to an automatic nation-wide permit for their dredge and fill activities. Their complaint (Riverside versus Andrews) was denied in Colorado district court. The Corps contended that denial of the permit represented proper exercise of its authority to regulate water quantity, which would be affected by the project once it began operation. The Corps argued that it was exercising federal police powers by considering the project's environmental effects, which in this case included destruction of habitat of the whooping crane (an endangered species), and that the permit was denied on these grounds. The district court held that the Corp's action was correct. Riverside had argued that the Corp's authority was limited to the construction phase of the project only, and did not extend to the operational phase, in which minimal flow requirements, if there were to be any, would be determined by state water law, rather than federal laws. The court noted in Riverside versus Andrews: 'although the defendant's actions may have a substantial effect on state water rights, such is the case with many federal laws which particularly pre-empt state water laws.' Riverside's appeal of the district court decision is pending in Tenth Circuit Court. (Rochester-IVI)
W86-00564

EXERCISE OF FEDERAL JURISDICTION IN RESERVED WATER RIGHTS LITIGATION. UNITED STATES V. ADAIR, 723 F.2D 1394 (9TH CIR. 1983), CERT, DENIED SUB. NOM. OREGON V. UNITED STATES, 104 S. CT. 3536 (1984),
M. Reynolds.
Land and Water Law Review, Vol. 20, No. 2, p 511-521, 1985. 75 Ref.

Descriptors: *Federal jurisdiction, *Litigation, *Water rights, Reservation doctrine, Indian reservations.

When a suit originally filed by the United States in Oregon district court to obtain a declaration of water rights within the area once part comprising the Klamath Indian Reservation was adjudicated in favor of the federal government, the state appealed in Ninth Circuit Court on the grounds that the district court should have dismissed the suit. The Court of Appeals held that when a district court has proceeded to determine the nature and priority of water rights that are governed by federal law in a case involving Indian litigants, its decision should not be reversed. The Ninth Circuit court determined in this appeals case (United States versus Adair) that all three exceptions applying in the Arizona versus San Carlos Apache Tribe case also applied here. The court rejected the state's argument that the exercise of jurisdiction would be contrary to the policy of the McCarran Amendment. Although, at first glance, it appears that the Ninth Circuit correctly applied the San Carlos exceptions to the facts of Adair, the facts do not fit the exceptions ('express agreement to stay', 'adjudication of Indian rights', and 'delay in the motion to dismiss'). The court's dilemma in Adair was that, by the time the appeal was filed, the district court had taken 8 years to complete its work, and holding for the plaintiff would have meant starting over. In Adair, the district court should clearly have abstained under the Colorado River abstention doctrine, but did not. Not only did United States versus Adair undermine the Colorado River doctrine, but it violated the Supreme Court's guidelines in San Carlos. To avoid the dilemma presented by this case in the future water rights attorneys should appeal the denial of dismissal motion immediately, not after the completion of the district court's work. (Rochester-IVI)
W86-00565

COASTAL ZONE MANAGEMENT ACT: A PROTECTIVE MANDATE,
Natural Resources Defense Council, Inc., Washington, DC.
S. Chasis.
Natural Resources Journal, Vol. 25, No. 1, p 21-30, January, 1985. 51 Ref.

Descriptors: *Coastal Zone Management Act, *Legislation, Coastal areas, Standards, State jurisdiction, Federal jurisdiction, Resources management.

The rationale of the Coastal Zone Management Act (CZMA), its provisions, it problems of statutory structure and implementation, and the continued importance of its purpose are discussed. Review of the original debates at the time the Act was passed make clear the Congress recognized the deteriorating condition of coastal resources and the inability of state and local governments alone to effectively deal with the situation. A list of national coastal objectives was drawn up that included protection of natural systems, minimization of loss of life and property due to coastal development, and coordination and simplification of government procedures, among seven original items. Later, waterfront economic development and management of living marine resources were added, but attempts have been made to deny funding for this already broad responsibility on the grounds that the federal role is over, and that the states could and would assume full responsiblity for funding the programs. Thirty states (including those bordering the Great Lakes) and five territories are eligible for federal funds under the CZMA. Responsibility for administering the Act is assigned to the Secretary of Commerce, who designated the National Oceanic and Atmospheric Administration (NOAA) as the agency to manage the program. Within NOAA, the responsibility resides in the Office of Ocean and Coastal Resources Management. The statute is very broad, and participation is voluntary. A number of states have no coastal plans, and in others the coastal programs are ineffective. Federal implementation has been weak in the areas of standards for program approval, standards for review of state performance, and a lack of clarity about program benefits to the states. The needs existing at the time the CMZA was originally proposed still exist. State and local programs should be improved as a protection against the possible loss of the CMZA program, but because of the great national importance of the coasts, the program should not be terminated. (Rochester-IVI)
W86-00566

CZM FROM THE STATE PERSPECTIVE: THE NEW JERSEY EXPERIENCE,
Kinsey (David N.) Associates, Princeton, NJ.
D. N. Kinsey.
Natural Resources Journal, Vol. 25, No. 1, p 73-102, January, 1985. 108 Ref.

Descriptors: *Coastal Zone Management Act, *New Jersey, Resources management, Coastal areas, Land use, Nuclear powerplants, Urban areas.

The experience of the State of New Jersey (USA) with implementation of its responsibilities under the federal Coastal Zone Management Act (CZMA) is reviewed, including: incentives of the CZMA for coastal states, contents of the state's coastal management program, the Coastal Area Facility Review Act (CAFRA, New Jersey's main coastal zone management legislation), criteria for evaluating state coastal management programs, and case examples of the functioning of New Jersey's management effort. Among major issues that were dealt with under CAFRA are the growth of the Atlantic City region in the casino era, historic preservation and hotel-casino design, nuclear energy and coastal land use, and beach area transportation regulation and improvement. The net result of the New Jersey experience under CZMA is a firmly established, detailed, and working framework for coastal decision making by state agencies, local governments, and the private sector on a wide variety of uses of coastal resources. In light of the New Jersey experience the incentive of 'federal consistency' has proven only a negative control which could block a federal action, but could not require a federal agency to act affirmatively in a manner desired by a coastal state. A wide variety of regional and national interests in the coastal zone are now being considered more explicitly and with greater results than before enactment of the federal Coastal Zone Management Act. No constituency exists for coastal zone management by government per se, because each constituency has its own opinion about the best course and there is a general anti-regulation sentiment and desire for local control. The technical assistance provided by the federal coastal bureaucracy is extremely important and should be greatly expanded; the financial assistance to and through states to local governments under the CZMA is crucial. (Rochester-IVI)
W86-00567

CZM IN CALIFORNIA, OREGON, AND WASHINGTON,
Oregon Univ., Eugene.
R. G. Hildreth, and R. W. Johnson.
Natural Resources Journal, Vol. 25, No. 1, p 103-165, January, 1985. 346 Ref.

Descriptors: *Coastal Zone Management, *California, *Oregon, *Washington, Public participation,

Planning, Governmental interrelations, Resources management, Enforcement.

The coastal zone management (CZM) activities of the Bay Conservation and Development Commission (San Francisco), and the state programs of California, Oregon and Washington are discussed in terms of public participation, state and local government relationships, enforcement of program requirements, federal consistency with approved state programs, and development in hazardous coastal areas. Two of the three states which delegated substantial coastal planning responsibilities to local governments experienced significant delays in completing the process. The experience suggests that many local governments cannot or will not meet the technical requirements of comprehensive coastal planning, even with significant federal and state financial support. Inadequate enforcement of program requirements has been the most common criticism of CZM in all three states; reduction of the programs' comprehensiveness, both in terms of issues addressed and geography, is one possible solution to the enforcement problems. A central element of all West Coast programs has been the policy that development on shorelines and in tidal and submerged areas should not be allowed unless they are 'water dependent.' Experience has shown that the water-dependency concept describes a priority rather than absolute rule. Successful implementation of the water-dependency concept requires a strong monitoring and enforcement effort above the local government level. The significant effect that programs have had in improving coastal zone management in the three states over the last decade raises legitimate expectations for their future success. Monitoring problems are unlikely to be solved by any strikingly new institutional measures. (Rochester-IVI)
W86-00568

EXISTING INSTITUTIONAL ARRANGEMENTS AND IMPLICATIONS FOR MANAGEMENT OF TOKYO BAY,
Yokohama City Univ. (Japan).
K. Sumi, and K. Hanayama.
Natural Resources Journal, Vol. 25, No. 1, p 167-193, January, 1985. 3 Fig, 3 Tab, 68 Ref.

Descriptors: *Tokyo Bay, *Japan, *Resources management, Governmental interrelations, Institutional constraints, Water quality control, Bays, Harbors, Marine environment, Ports, Fisheries, Land reclamation.

Tokyo Bay has been central to Japan's economy for a long time; in the middle of the 18th Century the population of Tokyo was 1.3 million. The area surrounding Tokyo Bay produced 22% of Japan's total industrial output in 1980. Although the central government is located in Tokyo, most of the important decisions concerning the ecosystem of the bay are made by local governments, which operate at two levels: prefecture and community. The system of managing the marine environment and resources of Tokyo Bay is characterized by a complex network of ad hoc measures taken by central and local governments with respect to different uses, including land reclamation, fisheries, construction of port facilities and industrial plants, maintenance and management of port facilities, prevention of marine pollution, and control of total pollutant load. The national government has taken some action to prevent or reduce deterioration of water quality and to protect the marine environment. The Environment Agency has been ineffective; it has limitations upon its administrative activities and authority, and other government agencies have limited its powers. Local governments set their own 'quality standards' or 'emission standards', which in many cases are stricter than those set by the central government. Enforcement typically takes the form of guidance, with punishment being used as a last resort. Generally, Japanese environmental policies have concentrated on pollution abatement, with little attention given to maintenance or enhancement of environmental quality ('amenities'). Tokyo Metropolis, Kanagawa Prefecture, Yokohama City, and Chiba Prefecture have independently developed and regulated their portions of the bay area. Public participation in decisions regarding use of Tokyo Bay has been limited in the past, particularly at the stage of issue formulation. There is a lack of integration and comprehensiveness in the management of the Tokyo Bay marine environment and resources. Establishment of a single, comprehensive agency probably is not the solution at present. An inter-prefectural forum to coordinate government activities is more practical. (Rochester-IVI)
W86-00569

ENVIRONMENTAL MANAGEMENT OF THE MALACCA/SINGAPORE STRAITS: LEGAL AND INSTITUTIONAL ISSUES,
Resource Systems Inst., Honolulu, HI.
M. J. Valencia, and A. B. Jaafar.
Natural Resources Journal, Vol. 25, No. 1, p 195-232, January, 1985. 3 Fig, 3 Tab, 146 Ref.

Descriptors: *Malacca/Singapore Straits, *Legal aspects, *Institutional constraints, *Environmental policy, Singapore, Malaysia, Indonesia, International law, Law of the sea, Water pollution control, Navigation.

The Malacca/Singapore straits, an area of high ship traffic volume, petroleum development, and trading, involves three national governments: Singapore, Malaysia, and Indonesia, each of which has its own priorities and limitations in dealing with management of the environment. The involved states have not harmonized their respective environmental policies and regulations, nor have any of them introduced the necessary legislation required by the Convention on Law of the Sea. Contingency plans for dealing with marine pollution due to accidents exist at the national level, under the aegis of the Association of Southeast Asian Nations, and in the form of the Malacca-Singapore traffic separation scheme. Specific legal issues that may arise in this region include: spatial interference with transit passage, innocent passage versus transit passage, extension of traffic lanes, duties of port states, traffic management, prohibited zones for tanker operation, tanker safety standards (special design and equipment requirements), different standards for vessels that frequently navigate the Strait versus those that only do so occasionally, imposition of charges, increased liability and compensation requirements, and required contingency plans. A review of the environmental laws and updating of rules and regulations of the three states to implement the relevant provisions of the Law of the Sea Convention would provide the necessary stimulus for harmonizing of laws. Another approach would be to harmonize practices and reconcile pollution control regulations only with respect to major pollutants. Other alternatives include ratification or accession to major international conventions of environmental relevance, development of a joint contingency plan for the Malacca Strait, and establishment of a compensation fund. Possible bases for allocation of contingency fund contributions are risk, geography, economic position, and benefits derived from the Straits. A joint management authority is the most idealistic solution and is not likely at present. (Rochester-IVI)
W86-00570

ENVIRONMENTAL MANAGEMENT IN A NORTH SEA COASTAL ZONE: LAW, INSTITUTIONS AND POLICY,
Durham Univ. (England).
L. Guruswamy.
Natural Resources Journal, Vol. 25, No. 1, p 233-242, January, 1985. 33 Ref.

Descriptors: *North Sea, *England, *Coastal Zone Management, *Institutional constraints, *Legal aspects, *Environmental policy, Resources management, International law, Water pollution control, Alternative planning.

A project is described that will attempt to formulate an integrated environmental and resource strategy for the North Sea based on the World Conservation Strategy by analysis of the case of the coastal zone of the County Cleveland in the United Kingdom. The site is a formerly diverse marine habitat now 'reclaimed' for industrial development, agriculture, and utilities. The proposed study will be conducted in two phases. First, applicable law will be researched, whether it be United Kingdom, European, or international law, and the degree to which the laws are fragmented or integrated will be determined. The law, together with the institutions and policies relevant to pollution control and resource conservation, then will by analyzed, clarified, and restated. In the second stage of the project an attempt will be made to apply the strategy in a practical way to achieve given objectives. In the first stage, uses natural resources in County Cleveland will be determined, the extent and nature of fragmentation or integration among pollution control, town and country planning, and conservation of species and habitat will be examined, and certain aspects of the European Parliament's relationship to the problems under consideration will be discussed. Conflicts of objectives within individual agencies, eg, water authorities, will be examined. In the operational phase of the project, an interdisciplinary approach will be taken to topics such as the following: an assessment of policy criteria and priorities in selecting use objectives for natural resources, a determination of sources of relevant pollution and wastes, consideration of alternative production processes, and an investigation of the feasibility of recycling some pollutants. (Rochester-IVI)
W86-00571

CHESAPEAKE BAY: SAVING A NATIONAL RESOURCE THROUGH MULTI-STATE COOPERATION,
Bureau of National Affairs, Inc., Washington, DC.
Dept. of Environment, Safety and Health Services.
M. A. Hutter.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 185-207, 1985. 167 Ref.

Descriptors: *Chesapeake Bay, *Resources management, Governmental interrelations, Water pollution control, Environmental policy, Aquatic plants, Bays, Water pollution sources.

The value of the Chesapeake Bay as a natural resource, its decline as the result of pollution and other problems, and federal and state efforts to restore the Bay, from the December 1983 Chesapeake Bay Conference to the present, are reviewed. The Chesapeake Bay has more than 2,500 sq mi of surface area and about 8,000 miles of shoreline; it supports extensive recreation, port, and industrial activities. A 5-yr Environmental Protection Agency (EPA) study of the Bay's deterioration focused on three problems: loss of submerged aquatic vegetation, increases in concentrations of toxic chemicals, and nutrient enrichment. Four major phenomena were identified in 1982 and 1983 as contributing to the Bay's decline: population growth, increased urbanization, intensified agricultural activity, and wetlands loss. The Chesapeake Bay agreement of 1983, involving state Governors, the Mayor of Washington, District of Columbia (DC), and the EPA Regional Administrator, mandated twice yearly review of progress of Bay programs and annual reports on progress in implementation. Federal initiatives have been taken through EPA under the Clean Water Act. Other departments of the federal government have entered into joint resolutions with EPA agreeing to protect and enhance the condition of the Bay. In addition, state initiatives by Maryland, Virginia, Pennsylvania, the District of Columbia, and cooperative agreements, such as the Chesapeake Bay Commission, address specific problems created by each region's particular effect on the Bay. The key to the Chesapeake Bay Program's success so far has been cooperation and coordination among the federal and state agencies. It could take years, if not decades, however, for major programs established over the past year to become effective. The project is long-term and ongoing; reassessment of Bay programs in light of preliminary results will be necessary to keep restoration efforts oriented toward established goals. (Rochester-IVI)
W86-00572

PROBLEM OF PEOPLE: CRITICAL AREAS AND FLOATING ZONES IN THE CHESAPEAKE,

Briscoe, Kenney, Kaminetz and Lacer, Lexington Park, MD.
J. A. Kenney, III.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 209-218, 1985. 38 Ref.

Descriptors: *Chesapeake Bay, *Land use, *Floating zones, *Critical areas, Maryland, Zoning, Wildlife, Habitats, Recreation, Resources development.

Maryland's Chesapeake Bay Critical Area Act authorizes local jurisdictions to develop and implement programs to control the use and development of sensitive shoreline areas, designated by the act as 'Critical Areas.' The traditional approach to zoning involves a constant war for land use flexibility. The 'floating zone' concept was developed to permit certain land uses in accordance with an overall development plan for a designated area of land, without requiring a legislative determination of 'change or mistake' at the time of a comprehensive rezoning. A floating zone is a specialized use district created by ordinance that 'floats' over an entire jurisdiction until it attaches to a specific property upon the petition of the property owner. A site plan, which typically includes restrictions on maximum building area, minimum green area, and, in some cases, requires off-site improvements, must be approved by the local governing body. Plan approval can be revoked if the plan's provisions, including restrictions, are not complied with, or if there is no meaningful development within a reasonable period of time. In one case, a 200-acre development on the Patuxent River was approved under a floating zone. The project included a central marina, habitat preservation areas, community beach areas with restricted access areas, and central sewage; the density was increased from 1.0 units per acre to 2.83 units per acre as a result of rezoning. Numerous conditions were imposed, covering such areas as street design, parking, sediment and stormwater control, and limitations on pleasure boat mooring and use. The cost of development in this instance were borne by the private sector, and the costs of maintaining wildlife habitats were borne by the people with access to them. The floating zone and planned unit development concept can be an effect means to meet increasing development pressure in a creative, positive way. (Rochester-IVI)
W86-00573

INTERAGENCY DISPUTES OVER DRY FIELDS OR CLEAN WATER: A CASE STUDY OF THE CONFLICT BETWEEN AGRICULTURAL DRAINAGE PROGRAMS AND THE CHESAPEAKE BAY CLEANUP,
Arnold and Porter, Washington, DC.
For primary bibliographic entry see Field 6G.
W86-00574

POINT SOURCE WATER QUALITY CONTROL IN VIRGINIA: CHOICES FOR THE CHESAPEAKE,
Chesapeake Bay Foundation, Inc., Richmond, VA.
For primary bibliographic entry see Field 5G.
W86-00575

MAJOR ENVIRONMENTAL STATUTES AFFECTING THE JAMES RIVER,
Thomas and Fiske, Richmond, VA.
T. G. Hayes.
Virginia Journal of Science, Vol. 36, No. 1, p 37-44, Spring, 1985.

Descriptors: *Legislation, *James River, *Virginia, *Environmental effects, Policy, Regulations, Water pollution control.

The most important of the numerous federal and state laws enacted that directly or indirectly control the impacts of human activity on our waterways are reviewed and, in some cases, related to the James River. Laws discussed include the National Environment Policy Act of 1969, the Clean Water Act, the State Water Control Law (Virginia), the Rivers and Harbors Appropriation Act of 1899, Marine Resources Commission Permits, Resource Conervation and Recovery Act, State Solid Waste Management, Toxic Substances Control Act, Federal Environmental Pesticide Control Act, Ports and Waterways Safety Act, Atomic Energy Act, and the Comprehensive Environmental Response, Compensation and Liability Act of 1980. (Baker-IVI)
W86-00586

6G. Ecologic Impact Of Water Development

ASSESSMENT OF ENVIRONMENTAL CONSIDERATIONS IN THE DESIGN AND CONSTRUCTION OF WATERWAY PROJECTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
F. D. Shields, and M. R. Palermo.
Technical Report E-82-8, September 1982. Final Report. 214 p, 71 Fig, 5 Tab, 156 Ref, Append.

Descriptors: *Environmental effects, *Waterways, *Construction, *Channel improvement, *Flood control, *Water quality, *Aquatic habitats, Levees, Dikes, Navigation, Bank protection, Protection, Stream stabilization, Stream banks, Transportation, Aquatic animals, Meanders, Habitats, Species diversity, Vegetation, Riparian vegetation, Land use, Aesthetics, Recreation, Wolf River.

Factors and constraints in design and construction of waterways projects affecting environmental quality are identified. Included are channel modifications for flood control and navigation, dikes, streambank protection, and levees. Adverse environmental impacts of flood control channel modification include a variable degree of loss of valuable habitats and habitat diversity, channel instability, reduction of aesthetic value, water quality degradation, and undesirable hydrologic changes. Methods to reduce adverse impacts are stream restoration, artificial instream structures, modified channel cross sections, and management of cutoff meanders. Navigation channel modifications produce losses in backwater habitat. Dike construction reduces water surface area and habitat diversity due to sediment accretion in the dike field. Notches or gaps in the dikes can slow the rate of sediment accretion. Bank protection causes loss of riparian vegetation and reduces the rate of channel migration. Some bank protection devices are vegetation and combinations of structure and vegetation. Levees create drier conditions on the landside of the levee and resulting land use changes. Vegetation on levees can be managed to preserve or improve wildlife habitats, aesthetics, and recreational features.
W86-00315

BENTHIC MACROINVERTEBRATES OF SELECTED AQUATIC HABITATS OF THE LOWER MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W86-00324

INSTRUCTION REPORT ON FRESHWATER MUSSELS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W86-00325

USER'S MANUAL FOR THE EVALUATION AND SENSITIVITY ANALYSIS PROGRAM (ESAP),
Colorado Univ. at Boulder. Center for Research on Judgment and Policy.
J. Mumpower, and L. Bollacker.
Technical Report E-81-4, March 1981. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 279 p, 131 Fig, 3 Tab, 4 Append.

Descriptors: *Planning, *Environmental policy, *Water resources development, *Water management, *Sensitivity analysis, *Evaluation, Environmental effects Alternative planning.

The Evaluation and Sensitivity Analysis Program (ESAP) is an environmental planning technique for the evaluation of alternative water resource management plans. ESAP is based on a weighting-scaling approach to impact assessment and alternative evaluation. The evaluation of the desirability or acceptability of an alternative is based on a systematic combination of information about the impacts on the natural and cultural resources and information about the importance (weight) and preferred levels of such resources. Information for a number of individuals or groups is used to determine how sensitive their evaluations are to differences in judgments about the importance and preferred levels of resources or to uncertainty in projections of resource impacts. The analysis performed by ESAP provides the user with to basic types of information: (a) an evaluation of the alternatives for each individual or group considered and (b) an analysis of how the individuals or groups differ in their evaluation of alternatives. The analysis requires the user to provide a hierarchial description of the evaluation problem, which includes the variables or resources affected by the alternatives, projected levels of the variables or resources for each of the alternatives, and information about the weights or importance values and the variables for each of the groups under consideration. If the user wishes to examine the effects of uncertainty on evaluation, data describing uncertainty must also be input into the program. (Author)
W86-00328

REPORT OF FRESHWATER MOLLUSKS WORKSHOP, MAY 19-20, 1981.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
Vicksburg, MS. Final Report, May 1982. Andrew C. Miller, compiler. 192 p.

Descriptors: *Environmental effects, *Rivers, *Mollusks, *Aquatic habitats, *Shellfish, Taxonomy, Endangered species, Higgin's eye mussel, Mussels, Aquatic animals, Sampling, Habitats, Lampsilis higginsi, Mississippi River.

A workshop on freshwater mollusks addressed the following subjects: (1) taxonomy and ecology of freshwater mussels, (2) appropriate sampling methodologies for mollusks, (3) methods to create habitat and/or relocate mollusks, (4) information available from commercial shell harvesters and (5) present and past concerns about endangered species. Although much of the data concerned the Upper Mississippi River and the Tennessee and Alabama river systems, the information can be applied to all freshwater mollusks regardless of location. The Endangered Species Act and program were described. Applying the taxonomic and ecological principles of immature biomes (as found in northern North America) to mature biomes (as found in the southeastern U.S.) are shown. Museums are a valuable resource in identification of mollusks; 25 museums are listed for reference. Of sampling techniques available, diving is best for deep water sampling, and hand-picking is best for shallow water. Brailing is effective for cursory surveys in large rivers. Mechanical dredges should be avoided. Other mollusk studies described are the distribution of Mobile Basin unionid mollusks, the Cumberlandian mollusk conservation program, relocation of an endangered species (Higgin's eye pearly mussel), the role of the U.S. Army Engineers in mollusk studies, and commercial aspects of mollusks.
W86-00329

OVERVIEW OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 8A.
W86-00332

MAJOR PROJECT IN THE AGE OF THE ENVIRONMENT: OUT OF CONTROVERSY, COMPLEXITY, AND CHALLENGE,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 6E.

W86-00333

HYDROLOGY, HYDRAULIC, AND SEDIMENT CONSIDERATIONS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
K. D. Underwood, and F. D. Imsand.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 69-90, 1985. 14 Fig, 10 Tab, 53 Ref.

Descriptors: *Tennessee-Tombigbee Waterway, *Construction, *Sedimentation, *Hydrology, Engineering, Water resources development, Hydraulic engineering, Design criteria, Monitoring.

The hydrology and hydraulic aspects of the Tennessee-Tombigbee Waterway system are described along with the hydraulic design of the hydraulic features, followed by a discussion of sedimentation characteristics of the waterway. A brief discussion is offered of the monitoring programs for the hydrological and sedimentological aspects of the project. Ten locks and dams were constructed that form lakes with a total water surface area of over 42,400 acres. The overall length of the waterway is 234 miles and required the excavation and disposal of over 307 million cu yd of material. Specific topics considered include climate, hydrology, sections of the waterway (river sections, canal section, and divide section), design and construction of the navigation channels, locks and dams and spillways, sedimentation, and project monitoring (river stage and stream gauging, and rainfall stations). (Baker-IVI)
W86-00336

CREATIVE SPOIL: DESIGN CONCEPTS, CONSTRUCTION TECHNIQUES, AND DISPOSAL OF EXCAVATED MATERIALS,
Louisiana State Univ., Baton Rouge. School of Environmental Design.
For primary bibliographic entry see Field 8A.
W86-00337

SUMMARY OF ENVIRONMENTAL ISSUES AND FINDINGS: TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
N. D. McClure, IV.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 109-124, 1985. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Tennessee-Tombigbee Waterway, *Construction, *Environmental effects, Decision making, Planning, Water resources development.

The enactment of the National Environmental Policy Act (NEPA) had a substantial influence on the manner in which the Tennessee-Tombigbee Waterway (Tenn-Tom) was constructed. The interdisciplinary approach including a board of outside consultants functioning as environmental advisors, played a valuable role toward meeting the objectives of minimizing adverse impacts and maximizing the positive environmental aspects. Impacts of the Tenn-Tom addressed include aquifer drawdown, waterlogging, water quality, interbasin transfer, mixing of species, endangered species, erosion, sedimentation, and loss of wildlife habitat. The findings are discussed, and the identified impacts placed into perspective. While implementation of the Tenn-Tom waterway involved losses and resource tradeoffs, measures have been incorporated into the project to mitigate for significant resource losses. The evaluation, planning, and design process for the Tenn-Tom can serve as model approach for compliance with NEPA and other environmental statutes. (Baker-IVI)
W86-00338

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER, RIVER MILE 480-530: REPORT 2, AQUATIC HABITAT MAPPING,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
S. P. Cobb, and J. R. Clark.
Miscellaneous Paper E-80-1, U.S. Army Environmental and Water Quality Operational Studies, March 1981. 24 p, 4 Fig, 1 Tab, 3 Plates.

Descriptors: *Aquatic habitats, *Aquatic environment, *Aquatic life, Mapping, Impact, *Flow rates, *Lower Mississippi River, Channels, Banks, Sandbars, Dike fields, Floodplains, Borrow pits, Maps.

To provide data for design of field studies to determine the impacts and ecological value of the man-made habitats formed by dike and revetment structures in the Lower Mississippi River, the aquatic habitat of a 50-mile reach of the river (mile 480-530 Above Head of Passes, AHP) was quantitatively mapped to determine spatial relationships among and within habitat types as a function of river and discharge. Twelve aquatic habitat types were defined within the study reach based on hydraulic, geomorphological, and ecological criteria: main channel, natural banks, revetted banks, sandbars, dike fields, permanent and temporary secondary channels, abandoned river channels (Types I and II), oxbow lakes, borrow pits, and inundated floodplain. By use of controlled aerial photography and hydrographic survey data, aquatic habitat surface acreages were computed for three river stages (low flow=+13.2 ft, medium flow=+24.6, and high flow=+38.4 ft on the Greenville, MS gage). Results of the habitat mapping revealed a significant change in total aquatic habitat acreage with changes in river stage and discharge. At the low flow stage 18,581 acres of habitat were present. Habitat area increased to 29,020 acres at medium flow and rose to 56,902 acres for high flow, a total increase of 222% in area over low flow conditions. The main channel was the predominant habitat type during the low flow period, composing 45% of total habitat. Dike fields and the main channel were the most abundant habitat types at medium flow, making up 28 and 29% of total habitat, respectively. For the high flow period, inundated floodplain habitats were the most common habitats, comprising 27% of the total aquatic habitat. Variation in river stage and discharge caused a significant change in the spatial relationships.
W86-00373

STABILITY OF ARTIFICIALLY-DRAINED LOWLANDS: A THEORETICAL ASSESSMENT,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
J. D. Phillips.
Ecological Modelling, Vol. 27, No. 1/2, p 69-79, March, 1985. 2 Fig, 1 Tab, 31 Ref.

Descriptors: *Model studies, *Drainage systems, *Artificial watercourses, *Wetlands, *North Carolina, Stability, Lowlands, Water resources development, Environmental effects.

The impacts of artificial land drainage on wetlands was investigated, using coastal plain lowlands of North Carolina as an example, from a holistic viewpoint. The rate of drainage channel degradation following construction of artificial drainage networks appears to be the key variable determining stability of surface hydrologic systems. If degradation is rapid, the system is metastable and a new equilibrium may be achieved within a few years, though a return to the pre-alteration state is unlikely. Limited data available in the North Carolina coastal plain indicate that artificially-drained lowland hydrologic systems are metastable. Ditch and canal degradation is rapid after initial disturbance, but unmaintained channels do persist. More data are needed, however, on rates and processes of drainageway degradation and on the persistence of manmade stream networks. It appears that regular dredging, re-excavation, snagging, and vegetation removal in ditch-and-canal systems in North Carolina is limiting the ability of natural systems to adjust to perturbations and is maintaining the hydrologic system and, by extension, the ecosystem, in an unstable state. (Baker-IVI)
W86-00434

CONCORDANT VARIATION IN THERMAL TOLERANCE AND ALLOZYMES OF THE RED SHINER, NOTROPIS LUTRENSIS, INHABITATING TAILWATER SECTIONS OF THE BRAZOS RIVER, TEXAS,
North Texas State Univ., Denton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-00452

PROBLEM OF SARDINE FISHERIES IN EGYPT,
Institute of Oceanography and Fisheries, Alexandria (Egypt).
For primary bibliographic entry see Field 5C.
W86-00525

ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT OF THE JONGLEI CANAL PROJECT, SOUTHERN SUDAN,
Khartoum Univ. (Sudan). Inst. of Environmental Studies.
A. I. Moghraby, and M. O. Sammani.
Environmental Conservation, Vol. 12, No. 1, p 41-48, 1985. 2 Fig, 64 Ref.

Descriptors: *Environmental effects, *Social aspects, *Economic aspects, *Jonglei Canal, *Sudan, Cost-benefit analysis, Ecological effects.

The environmental and socio-economic impacts, as presently understood, of the Jonglei Canal project, southern Sudan, are reviewed, and it is concluded that completion of the project is justified both in terms of short- and long-term cost/benefit perspectives. Plankton and limnology, aquatic macrophytes, benthos and insect fauna, fish and fisheries, geography and geology, and wildlife are reviewed, and the socio-economic background of the 'Sudd' area is reviewed. Claims made for and against the building of the canal are reviewed, and possible changes in water quality, fisheries, and large wildlife are discussed. If the Jonglei Canal project is completed as planned, a new mode of life for both man and domestic and wild animals is anticipated. This new mode of life will be more satisfactory than the today's situation, which is already changing as the result of other causes unrelated to the canal project. (Rochester-IVI)
W86-00557

EFFECTS OF HUMAN ACTIVITIES ON ZAMBIA'S KAFUE FLATS ECOSYSTEMS,
Akron Univ., OH.
W. A. Sheppe.
Environmental Conservation, Vol. 12, No. 1, p 49-57, 1985. 8 Fig, 29 Ref.

Descriptors: *Environmental effects, *Kafue Flats, *Zambia, Dam effects, Flooding, Wildlife, Habitats, Vegetation, Aquatic plants, Water management.

The Kafue Flats, a 6,000 sq km floodplain area of the Kafue River, Zambia, has been affected by construction of two hydroelectric dams, one above the Flats at Itezhitezhi and another downstream from the Flats in the upper Kafue River Gorge. The Flats was studied for 12 mo in 1967-68, was visited in 1970 and 1971, and was studied for 6 wk in May-June 1983. In 1967, periodic flooding contributed to the support of a dense growth of emergent grasses across much of the area. Large herds of lechwe (Kobus leche), smaller numbers of zebra (Equus burchelli), wildebeest (Connochaetes taurinus), and other ungulates fed on the high ground, while one of the world's greatest agglomerations of avian biomass occupied the floodwaters and shoreline. At the same place in May 1983, the lower elevations on the floodplain were covered by permanent open water, and the higher elevations were perhaps permanently dry. The very productive vegetation had been largely replaced by aquatic plants in the open water, whereas the dry former floodplain had a sparse cover of low grasses and was being invaded by woody plants. There were few birds, relatively few lechwe, and no other large ungulates. Numerous less conspicuous changes had occurred in the vegetation, insect, bird, and small mammal populations. The effect of the dams was obscured by the effects of drought, hunting, and human use of the area. The long-term effects of the dams on the Kafue Flats are not now clear. Scheduled water releases or diking schemes

to control water in certain areas are alternatives that could help preserve wildlife habitat on the floodplain, but they conflict with maximum power generation, which is the current top priority for this system. (Rochester-IVI)
W86-00558

PROBLEM OF PEOPLE: CRITICAL AREAS AND FLOATING ZONES IN THE CHESAPEAKE,
Briscoe, Kenney, Kaminetz and Lacer, Lexington Park, MD.
For primary bibliographic entry see Field 6E.
W86-00573

INTERAGENCY DISPUTES OVER DRY FIELDS OR CLEAN WATER: A CASE STUDY OF THE CONFLICT BETWEEN AGRICULTURAL DRAINAGE PROGRAMS AND THE CHESAPEAKE BAY CLEANUP,
Arnold and Porter, Washington, DC.
T. J. Lindon, and M. P. Gergen.
Virginia Journal of Natural Resources Law, Vol. 4, No. 2, p 219-262, 1985. 241 Ref.

Descriptors: *Drainage effects, *Chesapeake Bay, *Water quality control, *Environmental effects, Upper Chester River Project, Maryland, Aquatic plants, Nutrients, Channeling.

The Environmental Protection Agency (EPA) study of the Chesapeake Bay has documented and substantial contribution made by agriculture to the deterioration of water quality of the Bay in terms of increased levels of nutrients in the water, decreases in numbers of submerged aquatic plants, and destruction of wetlands and associated vegetation. The Soil Conservations Service's (SCS) proposed Upper Chester River (Maryland) Project proposes to channelize streams to improve drainage on 9,400 acres of currently wet cropland and 5,200 acres of interdependent non-wet cropland. SCS did not adequately consider the adverse environmental consequences of this project in its Environmental Impact Statement (EIS), nor has it heeded or explored warnings of other government agencies with environmental expertise. These agencies lack effective mechanisms for forcing SCS to respond to their environmental concerns. In light of the Upper Chester River example, new approaches seem appropriate in three areas: (1) consideration of alternatives to channelization projects, since their negative environmental consequences are becoming more and more evident, (2) more attention by SCS to the concerns of other government agencies with more environmental expertise; this could be done in the forthcoming Supplemental EIS, and (3) the use by EPA of its as yet untested preemptory authority under section 404(c) of the Federal Water Pollution Control Act, which would allow it to prohibit, prospectively, the discharge of dredged or fill material at a particular site. (Rochester-IVI)
W86-00574

ECOLOGICAL ALTERATIONS OF IOWA PRAIRIE-AGRICULTURAL STREAMS,
Iowa State Univ., Ames. Dept. of Animal Ecology.
B. W. Menzel, J. B. Barnum, and L. M. Antosch.
Iowa State Journal of Research, Vol. 59, No. 1, p 5-30, August, 1984. 2 Fig, 10 Tab, 38 Ref. EPA grant R807122.

Descriptors: *Iowa, *Land use, *Streams, *Ecological effects, *Agriculture, Prairies, Sediments, Water quality, Habitats, Invertebrates, Fish, Nutrients, Channelization.

Water quality, habitat structure, and macroinvertebrate and fish communities were surveyed in 1979-1980 in ten headwater streams of the Cedar River basin. All streams are affected by moderate to intensive agricultural land use in their watersheds, and the purpose of the study was to describe stream ecological changes caused by this influence. Most streams carried heavy sediment and nutrient loads, had fine-particulate substrates, were extensively channelized, had a wide range in daily flows, and were largely devoid of instream vegetation. Water quality was highest and habitat structure was most complex in a woodland stream, and a pattern of environmental differences was measured among the nine prairie streams. Invertebrate communities were dominated by the collector-scraper functional assemblage. Shredders were primarily represented by amphipods, isopods, and crayfish. Ten fish species, mainly minnows, were identified as fish community dominants in all streams. Eight environmentally sensitive species were absent or present in only small numbers. The streams were classified into four groups on the basis of 12 biotic and abiotic characteristics which serve to provide a composite measure of ecological change from presumptive natural conditions. (Author's abstract)
W86-00581

ISSUES IN THE JAMES RIVER CORRIDOR,
Richmond Regional Planning District Commission, VA.
D. Arkin.
Virginia Journal of Science, Vol. 36, No. 1, p 7-13, 1985.

Descriptors: *Resources management, *James River, Virginia, Land use, Water supply, Water demand, Transportation, Urban areas, Recreation, Industries, Wastewater treatment, Environmental effects.

The role of the James River in the lives of the people living near it is large, including its use for water, transportation, recreation, industry, wastewater treatment, and a natural environment. The projected addition of more than 100,000 people to the Richmond Region by the year 2000 raises several issues affecting the river, including: water supply for power generation, human consumption, and industry, which is both a public health and economic issue, preservation of historic places and scenic areas associated with the James River, development of recreation and tourism, accomodation of growth pressures from residential, commercial, and industrial development, which requires control of land use, protection of the agricultural potential of the Richmond Region, and transportation problems associated with river use, access to the river, and the river as a barrier. A goal relating to these issues should be to determine 'reasonable and appropriate' uses of land in the James River corridor that meet the needs of the community and are compatible with what the land can best support. (Rochester-IVI)
W86-00582

HUMAN ECOLOGY OF THE JAMES RIVER,
Richmond Univ., VA. Dept. of Biology.
For primary bibliographic entry see Field 4C.
W86-00583

MODIFICATION OF THE JAMES RIVER,
Corps of Engineers, Norfolk, VA. Norfolk District.
F. T. Wootton, Jr.
Virginia Journal of Science, Vol. 36, No. 1, p 19-25, Spring, 1985. 7 Fig.

Descriptors: *James River, *Kepone, *Dredging, *Turbidity, Suspended solids, Environmental effects, Water resources development.

The James River Basin is 225 miles long, averaging 40 to 50 miles in width. The navigation portion of the James River is located at and downstream from Richmond. The Federal navigation project, authorized in 1870, is maintained so as to provide a channel 25 feet deep and 200 to 300 feet wide from Hampton Roads upstream to the Deepwater Terminal at Richmond. For a maintenance dredging project, a hydraulic pipeline cutterhead dredge was converted by fitting it with a dustpan head and ladder, to test the efficiency, output and environmental impacts while dredging in the James River. An environmental monitoring program was in place during the dredging tests, concentrating mainly on Kepone and turbidity. Material was deposited in the open water areas about 1,000 feet from the channel. Neither turbidity nor kepone levels increased significantly above background in the water column around the dredge head for either the dustpan or the cutter mode of dredging operation. The situation differed at the disposal area. While the turbidity and suspended solids in this area were similar, but slightly higher during the cutter mode, the dissolved kepone levels for the cutterhead averaged more than three times the levels during the dustpan mode. This may be explained by the fact that the cutterhead moved more than five times the amount of material moved by the dustpan, during more or less equal periods on the calendar. Overboard disposal proved to be economical and without serious environmental effects. (Baker-IVI)
W86-00584

JAMES RIVER FISHERIES AND THERMAL EFFECTS,
Richmond Univ., VA.
W. S. Woolcott.
Virginia Journal of Science, Vol. 36, No. 1, p 26-29, Spring, 1985. 6 Ref.

Descriptors: *Fisheries, *Environmental effects, *Thermal pollution, *James River, *Virginia, *Powerplants, Water resources development, Nuclear powerplants, Fish, Heated water, Water pollution effects.

Fishes represent the top trophic level in the James River, Virginia as they usually do in other aquatic habitats. Since the 1950's literally hundreds of studies of the effects of temperature on fishes have been made. Three electric power stations are discussed, Bremo Power Station, Chesterfield Power Station and Surry Power Station, which produce approximately one third of Vepco's total daily electric power output. The immediate impact of their heated effluents on fisheries in the James River is minimal and restricted to the nearby vicinity of the power station. Bremo Power Station impacts on the Piedmont part of the James. The impact is confined mainly to the first km below the outfall. Only occasionally were plume temperatures as far as 8 km downstream considered high enough to have a significant effect on fishes. Chesterfield Power Station is located near the upper reaches of the tidal James, in the middle of the spawning area of several anadromous species. Even so, the effect of this plant seems very small. Surry Power Station, the only nuclear fueled James River power station, is the only one specifically designed from day one to reduce its impact on the environment. Several features of the station have been responsible for the greatly reduced impact it might have otherwise had on the environment. When results of the environmental impact studies of the three James River power stations are compared it appears that they have in common a negligible, short term detrimental effect on fisheries. (Baker-IVI)
W86-00585

PECULIAR STRUCTURE OF THE TULAREMIA NATURAL FOCUS IN THE DON RIVER DELTA WITH SPECIAL REFERENCE TO ECONOMICAL INFLUENCE (SOVREMENNAYA STRUKTURA PRIRODHOGO OCHAGA TULYAREMII DELTY DONA V SVYAZI S KHOZYAISTVENNYM VOZDEISTVIEM),
Nauchno-Issledovatel'skii Protivochumnyi Inst., Rostov-na-Donu (USSR).
M. G. Protopopyan, V. G. Nalyotov, G. M. Medinskii, M. Ya. Semyonov, and A. E. Zakrutkin.
Zoologichesky Zhurnal, Vol. 64, No. 3, p 468-471, March, 1985. 1 Tab, 7 Ref.

Descriptors: *Public health, *Tularemia, *Rodents, *Don River Delta, *USSR, River flow, Fish farms, Drainage effects, Environmental effects, Epizootics.

Thirty years of economical usage of the Don River delta did not result in elimination of the tularemian epizootia. Anthropogenic factors (control of river flow, construction of fish farms, high roads, melioration and drainage) ensured the formation of peculiar, not characteristic of the classical foci of this type, faunistic complexes of rodents and changed

the focus spatial and biocoenotic structure. (Author's abstract)
W86-00593

7. RESOURCES DATA

7B. Data Acquisition

PHOTOGRAMMETRIC TECHNIQUES FOR MONITORING SOIL EROSION,
Georgia Univ., Athens. Dept. of Geography.
For primary bibliographic entry see Field 2J.
W86-00342

GROUNDWATER MONITORING AND SAMPLE BIAS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
R. W. Gillham, M. J. L. Robin, J. F. Barker, and J. A. Cherry.
American Petroleum Institute, Washington, DC., June, 1983, 206 p. 40 Fig, 14 Tab, 120 Ref.

Descriptors: *Monitoring, *On-site data collections, *Sampling, *Water sampling, *Reviews, *Water quality, *Groundwater pollution, Data interpretation, Data aquisition, Data collections, Groundwater, Water properties, Chemical properties, Physical properties.

The factors which can lead to uncertainty in groundwater quality data are systematically reviewed. Hydrogeologic factors which may cause bias or uncertainty are variations in regional flow characteristics, in physical and chemical controls on contaminant migration, and in porosity of media and hydraulic conductivity. Sample integrity can also be a potential source of bias in the evaluation of groundwater quality. Processes which may cause a loss in sample integrity include contamination of the geologic materials in the vicinity of the intake zone of the sampling installation by drilling, contamination from the instillation equipment or sampling materials, and contamination by sample degassing and volatilization or atmospheric substances. Human error may also affect sample integrity. The geochemical characteristics of several groundwater contamination parameters (pH, specific conductance, total organic carbon and total organic halogen) and the particular sampling precautions that are required for each are discussed. Particular consideration is given to the 29 parameters listed in the Resource Conservation and Recovery Act of the U. S. Environmental Protection Agency. In addition, four specific gasoline components are examined. Sampling objectives, data management and tests of difference, and sampling in the unsaturated zone are also discussed.
W86-00345

TRANSPORT, FATE AND EFFECTS OF ENERGY-RELATED POLLUTANTS: EVALUATION OF SURFACE AND GROUNDWATERS; APPENDIX 1: PRELIMINARY LISTING OF SENSITIVE SURFACE WATERS,
Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
For primary bibliographic entry see Field 5B.
W86-00348

CHARACTERIZATION OF BENTHIC MICROHABITAT; AN EXPERIMENTAL SYSTEM FOR AQUATIC INSECTS,
Illinois Univ. at Urbana-Champaign. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 2H.
W86-00443

DESIGN AND INSTALLATION OF LARGE WEIGHING LYSIMETERS,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 2D.
W86-00489

AUTOMATION OF A CLASS A EVAPORATION PAN,
Agricultural Research Service, Mississippi State, MS. Crop Simulation Research Unit.
For primary bibliographic entry see Field 2D.
W86-00499

DROP SIZE DISTRIBUTION MEASUREMENT PROBLEMS USING A LASER UNIT,
South Dakota State Univ., Brookings. Dept. of Plant Science.
R. A. Kohl, R. D. von Bernuth, and G. Huebner.
Transactions of the American Society of Agricultural Engineers, Vol. 28, No. 1, p 190-192, January/February, 1985. 4 Fig, 3 Ref.

Descriptors: *Lasers, *Measuring instruments, *Drop size, Sprinklers, Rain, Fluid drops,.

A He-Ne laser raindrop measurement unit was compared to the flour method for measuring raindrop size distributions from an agricultural sprinkler (spray type, 9.5 mm nozzle). The laser unit recorded fewer small droplets and more large drops compared to the flour method. Drops larger than the largest stable drop size were recorded by the laser system, even into the 8, 9, and 10 mm size classes. Recording of such drops resulted from two or more drops falling through the laser sensing area, one behind the other, in the 500 mm depth of field and somewhat offset. The result was coincidence error; recording of two or more drops as one larger drop. The probability of coincidence is very low (0.09% for a 2.5 mm drop at 50 mm/hr intensity) for a natural rain, but it increases to 5.3% for a 1.25 mm drop event at 500 mm/hr as occurs with an agricultural sprinkler. If 5.3% of the drops are incorrectly measured as twice as large as they really are, a volume error of 37% results. Several techniques were tried to remove the coincidence error from data, but without success. The laser system is therefore recommended for rainfall, but not for use with agricultural sprinklers. (Rochester-IVI)
W86-00502

USE OF DIALYSIS CELLS FOR INVESTIGATING PORE WATER COMPOSITION IN WETLAND SUBSTRATA, WITH PARTICULAR REFERENCE TO DISSOLVED IRON AND SULPHIDE,
Sheffield Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W86-00511

LANDSAT STUDY OF THE AQUATIC VEGETATION OF THE LAKE LUODONJARVI RESERVOIR, WESTERN FINLAND,
Oulu Univ. (Finland). Dept. of Astronomy.
For primary bibliographic entry see Field 2H.
W86-00532

RECORDING ECHO SOUNDER FOR ASSESSING SUBMERGED AQUATIC PLANT POPULATIONS IN SHALLOW LAKES,
Agricultural and Food Research Council, Oxford (England). Weed Research Organization.
C. J. Stent, and S. Hanley.
Aquatic Botany, Vol. 21, No. 4, p 377-394, April, 1985. 11 Fig, 2 Tab, 5 Ref.

Descriptors: *Aquatic plants, *Submerged plants, *Echo sounders, Remote sensing, Lakes, Water depth, Mapping.

This paper describes the design of a recording echo sounder which has a depth range of 6 m and can be used in shallow lakes and rivers to determine submerged plant heights and water depths. The instrument uses mainly digital techniques, has a liquid crystal display, and records echoes on standard audio cassettes. These are returned to the laboratory for analysis, using a microcomputer to produce various maps of the data. This system has been successfully used to map plant populations at several sites, the data for which are given. (Author's abstract)
W86-00533

8. ENGINEERING WORKS

8A. Structures

VALIDATION REPORT: COMPUTER PROGRAM FOR DESIGN AND ANALYSIS OF INVERTED-T RETAINING WALLS AND FLOODWALLS (TWDA),
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
W. A. Price, R. L. Hall, R. L. Mosher, C. C. Hamby, and R. Veselka.
Instruction Report K-81-3, February 1981. Final Report. 375 p.

Descriptors: *Structural engineering, *Soil mechanics, *Computer programs, *Design criteria, *Retaining walls, Walls, Load distribution, Stability analysis, Earth pressure, Soil pressure, Hydrostatic pressure, Seepage, Soil properties, Shear, Friction, Compressive strength, Earthquake engineering, Seismic properties, Water pressure, Reinforced concrete, Concrete, Stress, TWDA program.

Sample problems and their solutions verify the computer program TWDA (T-wall design/analysis), which is a user-oriented interactive, modular time-sharing program to aid in structural design and analysis of inverted-T retaining walls and floodwalls founded on earth or rock. The program has three major sections: executive command phase, stability modules (compute active earth pressures and determine overturning and sliding stability), and structural modules (perform stress analysis of the wall or design for minimum slab thickness). The program's goals are (1) a minimum-cost adequate design based on current codes and criteria, independent of the user's experience and (2) encouragement of personal judgment and imagination through interaction.
W86-00318

OVERVIEW OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
S. R. Green.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 9-13, 1985. 1 Tab.

Descriptors: *Tennessee-Tombigbee Waterway, *Water resources development, Mississippi, Alabama, Waterways, Construction, Lakes, Engineering, Navigation, Recreation.

When the Tennessee-Tombigbee Waterway of Mississippi and Alabama opened to commercial and recreational traffic on January 16, 1985, some 21 months ahead of schedule, it signaled the completion of the largest Army Corps of Engineers Civil Works project ever undertaken. The feasibility of the project was first studied by the Corps more than 110 years ago, but not reported as economically justified until 1938. Construction was authorized in 1946 by the River and Harbor Act which provided for a waterway connection between the inland navigation systems of the Tennessee, Ohio, and upper Mississippi Rivers, and the navigable Black Warrrier-Tombigbee River System which connects with the port of Mobile. The waterway is divided into three distinct sections depending on the means of construction. The utilization of different design and construction techniques was a balance of economics, construction capability, and environmental concern. The 10 lakes formed in the construction of the waterway impound 44,000 acres of water, used for recreation purposes as well as navigation. The benefits derived from the Tennessee-Tombigbee Waterway are virtually all transportation savings resulting from use of the waterway as opposed to alternate routes or modes of transportation. Recreation and fish and wildlife habitat enhancement amounted to only a few percentage points of the total benefits. (Baker-IVI)
W86-00332

CREATIVE SPOIL: DESIGN CONCEPTS, CONSTRUCTION TECHNIQUES, AND DISPOSAL OF EXCAVATED MATERIALS,
Louisiana State Univ., Baton Rouge. School of Environmental Design.
G. J. McLindon.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 91-108, 1985. 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Tennessee-Tombigbee Waterway, *Construction, *Design criteria, *Spoil disposal, Planning, Water resources development, Excavation, Environmental effects, Waterways.

Construction methods used in building the Tennessee-Tombigbee Waterway are reviewed including the disposal of surplus excavated materials and the reclamation of disposal areas along the waterway. Emphasis is placed on the steps taken to assure protection of natural resources and to promote overall enviromental quality. The overall design of the waterway and disposal of excavated materials was imaginative and positive, taking advantage of natural topography and utilizing techniques devised to overcome and accommodate the difficulties encountered. In keeping with the objective of locating disposal units in the least sensitive areas, three disposal sites utilized abandoned gravel pits, two sites being completely contained within the mined out area, the third partially contained. The vast majority of areas had no predetermined development use and, being in the floodplain, were designated as prime wildlife habitat locations. Investigation of several completed disposal areas indicate that natural revegetation is occurring at a satisfactory rate and that the natural flora contains an abundance of wildlife food plants. The disposal of hydraulically dredged material along the river section of the Tenn-Tom Waterway could have created massive long range environmental impacts. From the outset a positive attitude directed the methods of disposal into creative ventures. (Baker-IVI)
W86-00337

SELF-CLEANING, NON-POWERED TRASH SCREENS FOR SMALL IRRIGATION FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 4A.
W86-00490

8B. Hydraulics

BANK PROTECTION TECHNIQUES USING SPUR DIKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Copeland.
Miscellaneous Paper HL-83-1, January 1983. Final Report. 32 p, 22 Fig, 2 Tab, 24 Ref.

Descriptors: *Hydraulics, *Erosion control, *Bank protection, *Dikes, Scour, Protection, Channel erosion, Stream banks, Hydraulic models, Model studies.

The effects of impermeable spur dikes as a bank protection technique in a concave bend were studied with a hydraulic model. The tests were conducted to observe channel bed and bank response in a stream with noncohesive banks where suspended load is insignificant. The following conclusions were reached. Spacing-to-length ratios up to three may be effective in protecting concave banks with spur dikes; however, some bank protection may be needed. Spur dike roots should be protected from scour caused by vortices set up along the upstream and downstream faces. The spur dike should be aligned perpendicular to the bank or current. Aprons effectively limit the depth of scour at the dike's toe. The development of a scour hole at the dike toe may be slowed by the formation of an armor layer. Existing equations for scour prediction at spur dikes may not be applicable to dikes in concave bends.
W86-00311

PREVENTION OF SHOALING AT LITTLE LAKE HARBOR, MICHIGAN: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
W. C. Seabergh, and J. W. McCoy.
Technical Report HL-82-16, July 1982. Final Report. 373 p, 28 Fig, 8 Tab, 293 Plates, 13 Ref.

Descriptors: *Hydraulics, *Breakwaters, *Lakes, *Sedimentation, *Shore protection, Hydraulic models, Model studies, Shoals, Protection, Little Water Harbor, Michigan, Lake Superior, Channels, Boating, Navigation, Seiches.

A 1:75-scale hydraulic model was used to study the breakwater structures at Little Lake Harbor, Michigan, on the south shore of Lake Superior. Existing breakwaters have not prevented extensive shoaling in the entrance channel. It was determined that seiche oscillations with periods near the inlet-bay Helmholz period occurred frequently. These oscillations could generate velocities as high as 4.5 fps in the entrance channel, with a median velocity of 0.62 fps. Model tests indicated an optimum plan--a 570-ft long detached dogleg breakwater on the east side of the entrance. This structure would allow the gap between the new breakwater and the shore to close from sediment deposition. Adding a caisson at the lakeward terminus would not adversely impact shoaling patterns. This plan would also provide a straight-in approach for boat traffic and reduce seiche oscillations in the harbor and velocities in the entrance.
W86-00317

BOUNDARY-FITTED COORDINATE CODE FOR GENERAL TWO-DIMENSIONAL REGIONS WITH OBSTACLES AND BOUNDARY INSTRUSIONS,
Mississippi State Univ., Mississippi State. Dept. of Aerospace Engineering.
J. F. Thompson.
Technical Report E-83-8, March 1983. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 80 p, 20 Fig, 12 Ref.

Descriptors: *Computer models, *Computer programs, *Mathematical studies, Flow, Differential equations, Finite difference methods, Numerical analyses, Boundary processes.

A code (WESCOR) for the generation of boundary-fitted coordinate systems for general two-dimensional regions with boundaries of arbitrary shape and with internal obstacles and boundary intrusions, arbitrary in shape and number, is described and instructions for input and use are given. The coordinate system is generated from the numerical solution of a system of elliptic partial differential equations with provision for controlling the spacing of the coordinate lines in the field. The transformed (computational) region is rectangular with the obstacles and intrusions transformed to slits and/or slabs. A small code to distribute points on various fundamental curves with exponential concentration is also described. This procedure will be particularly useful where numerical models are used to analyze flow problems with complex boundary conditions. Typical examples are riverine analysis or the design and evaluation of selective withdrawal outlet works. (Author's abstract, modified)
W86-00323

DESIGN FOR FLOOD CONTROL, WAVE PROTECTION, AND PREVENTION OF SHOALING, ROGUE RIVER, OREGON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. R. Bottin.
Technical Report HL-82-18, August 1982. Final Report. 577 p, 6 Fig, 25 Tab, 424 Photos, 41 Plates, 21 Ref, Append.

Descriptors: *Hydraulics, *Shoals, *Jetties, *Sedimentation, *Shores, *Flood control, Hydraulic models, Model studies, Wave action, Rogue River, Oregon, Rivers, Dredging, Dikes, Harbors.

A 1:100-scale hydraulic model was used to investigate the effects of proposed improvements in the Rogue River, Oregon, harbor area with respect to shoaling, wave action, and riverflow conditions. The proposed improvements included (1) extensions and/or modifications of the present jetties, (2) dredging of a new entrance channel south of the existing one with an extension of the south jetty and construction of a new jetty, and (3) installation of dikes extending into the channel from the south jetty both with and without a weir section and conveyance channel installed on the north jetty and overbank. Several structures proved ineffective or caused new problems--a timber-pile dike extending from the south jetty, rubble-mound dikes, conveyance channel and weir section, and some configurations of jetty extensions. A plan involving a new harbor entrance south of the existing river mouth would cause a natural bypassing condition where the sediment on the north shoreline moves around the new middle jetty and toward the south shoreline. Wave heights in the harbor would be less than 1 ft for this plan.
W86-00326

HYDRAULIC MODEL STUDY OF CHOKE CANYON DAM SPILLWAY AND STILLING BASIN,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. L. George.
Report No. GR-82-9, August 1982. 30 p, 25 Fig, 3 Ref.

Descriptors: *Hydraulic models, Spillways, *Stilling basin, *Model studies, *Scour, Basins, Froude number, Riprap, Channel scour, Approach channels, Choke Canyon Dam, Texas.

A 1:80 scale hydraulic model of the Choke Canyon Dam spillway and stilling basin was studied. The dam will be 35 m high and have a crest length of 5,640 m. The spillway chute is 112.2 m wide and has a Froude number of about 4.4 at the stilling basin entrance. The stilling basin was designed to criteria developed for low Froude number flows. A modified entrance channel was developed as the model was tested. Stilling basin walls were shortened as a result of model studies. A 14-meter apron having 32 m of riprap extended downstream from the end sill was recommended. The design worked well for all discharges and scour was limited to an area downstream from the riprap.
W86-00382

LAKE SHERBURNE DAM MODEL STUDY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
B. W. Mefford.
Report No. GR-82-15, September 1983. 32 p, 23 Fig, 5 Ref.

Descriptors: *Hydraulic models, *Flow characteristics, *Spillway capacity, *Flow resistance, *Cavitation, Spillways, Outlets, Tunnel hydraulics, Channel flow, Lake Sherburne Dam, Flow, Montana.

Hydraulic model studies, on a 1:15 scale model of Lake Sherburne Dam, were conducted to evaluate flow conditions in the spillway and outlet works tower structure during the passage of the IDF (inflow design flood). Model tests on the existing structure revealed two areas where pressures were consistently negative, and a third area where intermittent roller vortices occurred during submerged spillway flows. A crown flow constriction was placed in each tunnel, downstream of the low pressure areas, in the hydraulic model. The constrictions were designed in conjunction with downstream air venting. The shape and location of these constrictions were changed several times to determine the discharge capacity versus localized upstream pressure recover. Nonsymmetric crown flow constrictions provided sufficient back pressure to raise the consistently low-pressure areas to acceptable levels during the design discharge. Roller vortices occurred due to a 90 deg square-edged flow boundary on each side of the tower

structure. Large radius fillets were placed in the 90 deg corners to eliminate the vortex action.
W86-00383

8D. Soil Mechanics

VALIDATION REPORT: COMPUTER PROGRAM FOR DESIGN AND ANALYSIS OF INVERTED-T RETAINING WALLS AND FLOODWALLS (TWDA),
Army Engineer Waterways Experiment Station, Vicksburg, MS. Automatic Data Processing Center.
For primary bibliographic entry see Field 8A.
W86-00318

UNWATERING THE DIVIDE CUT OF THE TENNESSEE-TOMBIGBEE WATERWAY; A MAJOR CHALLENGE TO CONSTRUCTION,
Army Engineer District, Nashville, TN.
M. D. Simmons.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 51-67, 1985. 10 Fig, 1 Tab, 21 Ref.

Descriptors: *Tennessee-Tombigbee Waterway, *Construction, *Divide Cut, *Dewatering, Excavation, Canals, Water resources development, Groundwater.

The construction of the Divide Cut of the Tennessee-Tombigbee Waterway required excavation of more than 150 million cu yd of unconsolidated sand and clay. A project of this magnitude was unprecedented for the Corps of Engineers. The excavation of the unconsolidated materials required the lowering of the artesian groundwater by an average of over 50 feet in order to construct and maintain safely and economically the side slopes of the canal. The materials excavated were fine-grained sand with thin layers of interbedded clay at intervals ranging from a few inches to 10 feet or so. The artesian pressures were lowered to a safe level through the use of deep wells while the remaining interstitial water was removed to the extent necessary for equipment excavation by narrow trenches constructed ahead of mass excavation. Numerous piezometers were used to monitor the lowering of the artesian groundwater pressures as the excavation progressed. The project has demonstrated that soil materials in areas of high artesian heads can be safely excavated by lowering the artesian pressures with deep wells and can be sufficiently unwatered with trenches so rubber-tired equipment can be used for excavation. Large-scale field testing proved to be of extreme value in developing appropriate construction techniques and is considered to be a necessary component in order to successfully produce a design for any project of this magnitude. (Baker-IVI)
W86-00335

CEMENT-MODIFIED SOIL IN CANAL LINING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8F.
W86-00381

8E. Rock Mechanics and Geology

HYDROGEOLOGICAL AND GEOTECHNICAL ASPECTS OF THE TENNESSEE-TOMBIGBEE WATERWAY,
Corps of Engineers, Mobile, AL. Mobile District.
J. H. Bryan.
Environmental Geology and Water Science, Vol. 7, No. 1/2, p 25-50, 1985. 17 Fig, 3 Tab, 10 Ref.

Descriptors: *Water resources development, *Tennessee-Tombigbee Waterway, *Hydrogeology, *Engineering geology, Canals, Waterways, Construction, Environmental effects, Earthquakes, Locks, Dams.

A few of the more significant hydrogeologic and geotechnical aspects of the Tennessee-Tombigbee Waterway are summarized. Some typical engineering and environmental problems are covered, along with a few of the more complex problems and how they were dealt with at specific sites. The concentration is primarily on the River and Canal sections of the Waterway. The general geologic setting is described with emphasis on seismicity, and mineral resources. Groundwater hydrology is described including hydrogeologic conditions along the flood plain, environmental and pre-construction investigations. Geotechnical explorations and design studies are reviewed along with optimizing conditions for the locating of locks and dams, the adaptation of design and construct to geologic conditions, construction dewatering for river and canal sections, impact on hydrogeologic and geologic environment, and continued monitoring and evaluation tasks. (Baker-IVI)
W86-00334

8F. Concrete

DESIGN OF DOWELS FOR ANCHORING REPLACEMENT CONCRETE TO VERTICAL LOCK WALLS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
T. C. Liu, and T. C. Holland.
Technical Report SL-81-1, March 1981. Final Report. 77 p, 42 Fig, 13 Tab, 17 Ref, 2 Append.

Descriptors: *Concrete construction, *Steel, *Locks, Dowels, Design criteria, Waterways, Shear tests, Resins.

Dowel pullout tests and shear transfer tests were performed to evaluate the pullout performance of dowels and the influence of dowel spacing on the load carrying capacity of replacement concrete cast during rehabilitation of vertical walls in navigation locks. The dowels were installed with a polyester resin cartridge system. For embedment lengths less than 15 times the dowel diameter, failure was generally caused by slippage along the concrete-resin interface. Performance of dowels installed under field conditions was acceptable. Within the range of the percentage of steel used in the laboratory shear transfer tests, the effect of the dowels did not appear to increase significantly the load-carrying capacity of the test specimens. The bond between the new and old concrete was more significant than the amount of steel present. The coefficient of friction between the new and old concrete was 1.35. In failure tests two modes were observed. In specimens without dowels the new concrete suddenly dropped onto the old concrete. In specimens with dowels the dowels prevented complete separation of the two pieces of concrete.
W86-00312

CONCRETE PERFORMANCE AT PUEBLO DAM, COLORADO: INITIAL CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
L. G. Mogck, and E. R. Dunstan.
Report No. GR-80-7, March 1982. 38 p, 10 Fig, 8 Tab, 6 Ref.

Descriptors: *Concrete technology, *Concrete testing, *Strength, Elastic properties, *Physical properties, *Concrete mixes, Concretes, Cores, Tensile strength, Compressive strength, Poisson ratio, Pozzolans, Pueblo Dam, Colorado.

Physical properties of initial cores extracted from the dam and river plug at Pueblo Dam, Colorado, indicate a good quality, uniform, well-consolidated concrete. This study is part of a series in the long-term evaluations of strength and elastic properties of concrete in various dams. The river plug concrete included two mix designs designated as interior and exterior. The dam concrete included two mix designs noted as high of low water to cement plus fly ash ratio. Results of the tests on the 3-year cores from the river plug show the average compressive strength of the concrete to be about 40 MPa, with no increase over the 6-month strength. The average 1-year dam concrete compressive strength was about 30 MPa, which is an increase over that at 6 months age. The modulus of elasticity for the interior plug concrete at 3 years is about 30 GPa with no significant increase with age. The 1-year dam concrete modulus of elasticity is about 35 GPa. Poisson's ratio, density, mix design, and tensile strengths of construction joints and monolithic specimens are also discussed.
W86-00380

CEMENT-MODIFIED SOIL IN CANAL LINING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones.
Report No. GR-82-4, August 1982. 31 p, 14 Fig, 3 Tab, 13 Ref, 2 Append.

Descriptors: *Cements, *Canal linings, *Erosion control, *Soil stabilization, *Soil cement, Canals, Silt, Loess, Portland cements, Erosion, Driftwood Canal.

In 1958, test sections of silty loessial soil lining treated with portland cement were installed on one side of the Driftwood Canal to resist erosion from water action. This canal, located near McCook, Nebraska, has a capacity of 6.3 cu m/s. The cement, in amounts of 4.5 percent by volume for one section and 2.5 percent for another was mixed with the soil in 600-mm-wide horizontal strips in the lining, which was otherwise constructed as a normal thick-compacted soil lining. In 1981, the cement-treated soil was sampled and laboratory compressive strength and durability tests were performed. Although the soil with 4.5 percent cement was cracked and had a blocky structure, it has resisted erosion reasonably well, even on a curve. The test reach with 2.5 percent cement resisted erosion slightly better on a straight section than the opposite untreated side. However, this section did not contain sufficient cement to adequately resist erosion on a curve.
W86-00381

CONCRETE PERFORMANCE IN MORROW POINT DAM: 10-YEAR CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
O. R. Werner, and D. Mudrick.
Report No. GR-81-5, March 1981. 44 p, 7 Fig, 7 Tab, 1 Append.

Descriptors: *Concrete technology, *Cores, *Concrete testing, *Strength, *Elastic properties, *Physical properties, *Concrete dams, *Mass concrete, Tensile strength, Compressive strength, Poisson ratio, Morrow Point Dam, Colorado.

The Bureau of Reclamation monitors the structural behavior of concrete dams for many years after completion. Concrete core evaluation programs are also conducted at various ages on major dams. This report presents test results on concrete cores taken from Morrow Point Dam up to 10 years' age. The physical properties tests conducted on 250-mm(10-in) diameter cores at 60 days, 180 days, 1 year, 5 years, and 10 years indicate that overall condition of the concrete is good. The thin-arch design used at Morrow Point required a higher than normal compressive strength for mass concrete. Most mass concrete dams built previously contained interior and exterior mixes; however, with the higher compressive strengths maintained at Morrow Point, a single mix was sufficient for the entire structure. The compressive strength of the mass concrete at 10 years averaged 51.6 MPa (7,480 lb/sq in). Also at 10 years, the modulus of elasticity and Poisson's ratio averaged 35.1 GPa (5,090,000 lb/sq in) and 0.24, respectively. The tensile strength of all cores tested at 10 years averaged 1.59 MPa (230 lb/sq in), which is comparable to tensile strengths for other Service dams.
W86-00384

CONCRETE PERFORMANCE IN CRYSTAL DAM, COLORADO: 1-YEAR CORE REPORT,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
T. A. Gaeto.
Report No. GR-81-8, June 1983. 30 p, 9 Fig, 3 Tab,

4 Ref.

Descriptors: *Concrete testing, *Concrete dams, *Concrete technology, *Strength, *Elastic properties, *Physical properties, Concretes, Cores, Tensile strength, Compressive strength, Poisson Ratio, Construction joints, Crystal Dam, Colorado.

Results of physical properties tests conducted on cores extracted from mass concrete in Crystal Dam for testing at 70 days', 6 months, and 1 year's age indicate good quality, uniform, well-consolidated concrete. This report contains test data through 1 year's age and is a part of a series of reports on long-time evaluations of strength and elastic properties of concrete in major Bureau of Reclamation dams. The average compressive strengths at 6 months and 1 year were 33.7 and 35.0 MPa (4,890 and 5,080 lb/sq in), respectively, which represent an average strength gain of 3.9 percent. Paralleling the strength increase, the moduli of elasticity also increased slightly from 31.4 to 31.7 GPa (4,550,000 to 4,600,000 lb/sq in). Tensile strengths for jointed and nonjointed cores were comparable at 6 months, but the nonjointed 1-year tensile strengths averaged 40 percent higher. Ratios of tensile to compressive strengths were high, indicating good paste-aggregate bond. Discussions of test results, variations, construction joint bond, and Poisson's ratio are also included in the report.
W86-00385

8G. Materials

STANDARD NUMBER 54: FLEXIBLE MEMBRANE LINERS.
National Sanitation Foundation, Ann Arbor, MI.
November 1983. 70 p, 15 Tab, 8 Append.

Descriptors: *Materials engineering, *Polymers, *Plastics, *Membranes, *Linings, Polyethylene, Polyvinyl chloride, Rubber, Epichlorohydrin polymer.

Standards for flexible membranes are given for many polymeric materials. Of particular interest are standards for potable water applications, the aquatic environment, and construction. Flexible membranes used in fishing ponds, agriculture, fish hatcheries, and recreational reservoirs should not adversely affect the environment. If information on prior use of a particular membrane is not available, special studies may be required. Properties of the following materials are given: polyvinyl chloride, chlorinated polyethylene, butyl rubber, polychloroprene, high density polyethylene, ethylene-propylene diene terpolymer, epichlorohydrin polymers, polyethylene ethylene-propylene alloy, high density polyethylene elastomeric alloy, chlorosulfonated polyethylene, thermoplastic nitrile, ethylene interpolymer alloy, and chlorinated polyethylene alloy.
W86-00320

GENESIS OF THE PROTECTIVE LAYERS UPON THE MILD STEEL SURFACE IN THE NEUTRAL NATURAL WATERS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).
V. Bischof, and J. Eliasek.
Acta Hydrochimica et Hydrobiologica, Vol. 12, No. 5, p 531-537, 1984. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Corrosion, *Steel, *Protective layers, Drinking water, Chlorides, Dissolved oxygen, Carbonates, Sulfates, Calcium, Magnitite, Alkaline earths.

Corrosion of mild steel in waters with dissolved oxygen takes place mostly with oxygen depolarization as the main reaction. The surface layer consists of the corrosion products and constituents of the surroundings. The formation of protective layers against corrosion was investigated by experiments performed in three different media: drinking water, drinking water enriched by chlorides and a concentrated chloride solution. The conditions for protective layer formation on mild steel in neutral water are given by the concentration of calcium and bicarbonate ions, which form layers of CaCO3 and FeCO3. During corrison processes nonstoichiometric hydrated magnetite is first formed. It is gradually oxidized and its structure changes to FeOH.H2O. The natural water components increase the oxidation rate, they yield crystallization nuclei, and they affect the space structure of compounds formed during corrosion reactions. A high availability of alkaline earths and hydrogen carbonate allows the formation of a protective layer consisting of FeOOH.H2O, CaCO3 and FeCO3. (Baker-IVI)
W86-00419

8I. Fisheries Engineering

HABITAT DEVELOPMENT FOR FRESHWATER MOLLUSKS IN THE TOMBIGBEE RIVER NEAR COLUMBUS, MISSISSIPPI,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller.
In: Report of Freshwater Mollusks Workshop, May 19-20, 1981, Vicksburg, MS. Final Report, May 1982. p 86-94, 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Environmental effects, *Rivers, *Aquatic habitats, *Mollusks, Shellfish, Tombigbee River, Aquatic insects, Insects, Riffles, Channel improvement, Habitats.

The U.S. Army Engineer Waterways Experiment Station has begun a project to design and monitor a gravel bar habitat for aquatic insects and mollusks. This bar will be placed in the Tombigbee River near Columbus, Mississippi, river mile 232.9. This study has been divided into three phases: biological evaluation of the project area (to be initiated in the summer of 1981), design of the bar or bars, and subsequent monitoring of the habitat after construction by the U.S. Army Engineer District, Mobile. (Author)
W86-00330

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM ANNUAL REPORT - F.Y. 1981,
National Marine Fisheries Service, Seattle, WA.
R. Z. Smith, and E. Wold.
Available from the National Technical Information Service, Springfield, VA 22162 as PB83-11452 0. NOAA Technical Memorandum NMFS F/NWR-4, July 1982. 51 p. 13 Fig, 6 Tab, Append.

Descriptors: *Fisheries, *Fish hatcheries, Cost analysis, *Columbia river basin, Fish ladders, Salmon, Water pollution sources, Water pollution control.

FY 1981 was a very active year for the Columbia River Fisheries Development Program. Twenty-two hatcheries and two rearing ponds made releases during the year. The Toutle Hatchery, destroyed by the eruption of Mt. St. Helens, was mothballed until the habitat improves enough for anadromous fish to live in the Toutle River Basin. Stream improvement and irrigation diversion screening operated on a maintenance level. Only a few diversions in Idaho remain to be screened. All fish ladders were inspected by the operating agencies and repaired where necessary prior to the adult migration runs. Almost 3.5 million marked fall chinook were released from 18 hatcheries, of which 12 were funded under the Program, in 1981. One more year of marking remains in this four-year study. Initial data show that the fish are being caught in all the same fisheries as were fish from the 1961-64 fall chinook study. In 1981, the Program became directly involved with fish transportation in the Columbia River Basin. A total of > 8 million juvenile salmonids were trapped at Lower Granite, Little Goose, and McNary Dams and trucked/barged to a release site below Bonneville Dam. Activities during 1981 were mainly operational. By the close of 1981, pollution abatement facilities were completed and in operation at all Program hatcheries.
W86-00347

INFLUENCE OF THE FISH CLARIAS BATRACHUS ON THE PHYSICOCHEMICAL PROPERTIES OF WATER UNDER LABORATORY CONDITIONS,
Kalyani Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-00401

EVALUATION OF INSTREAM ENHANCEMENT STRUCTURES FOR SALMONID SPAWNING AND REARING IN A COASTAL OREGON STREAM,
Bureau of Land Management, Salem, OR. Salem District.
R. A. House, and P. L. Boehne.
North American Journal of Fisheries Management, Vol. 5, p 283-295, Spring, 1985. 5 Fig, 6 Tab, 21 Ref.

Descriptors: *Fisheries engineering, *Stream enhancement structures, *East Fork Lobster Creek, *Oregon, Salmon, Trout, Spawning, Streambeds, Stream rehabilitation.

East Fork Lobster Creek, Oregon is an example of a stream that lost much of its productivity as an anadromous salmonid stream following logging activities, intensive stream cleaning, and flooding. The stream in the study area was almost devoid of instream structures, resulting in a nearly total lack of spawning gravel and rearing habitat. Stream enhancement structures installed in East Fork Lobster Creek were successful and functional after two winters with usual freshets. The structures dramatically increased the diversity of the stream bed, trapped gravel, and created shallow gravel bars and deep, covered pools. Also, the number, size, and quality of the pools increased in areas with structures. Coho salmon (Oncorhynchus kisutch) and steelhead (Salmo gairdneri) spawning increased substantially, as well as the numbers of rearing coho, steelhead fry, and steelhead and cutthroat trout (Salmo clarki) parr. This study shows that similar degraded streams can be rehabilitated by properly designed enhancement programs. Such programs are effective and are needed to help ensure the protection of naturally spawning and rearing wild salmonid stocks and the survival of their young. (Author's abstract)
W86-00591

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

HAZARDOUS MATERIALS SPILLS-MANAGEMENT REVIEW,
Texas Transportation Inst., College Station.
J. T. Lamkin, D. P. Honan, J. A. Nickerson, J. L. Payne, and R. C. Speaks.
American Petroleum Institute, Washington, DC., 1981, 414 p. 5 Fig, 2 Tab, 5 Append.

Descriptors: *Oil spills, *Data collections, *Reviews, *Environmental protection, *Hazardous materials, *Transportation, *Education, *Data transmission, Data storage and retrieval, Data acquisition, Federal government, State governments, Management planning, Education, Training.

This study, funded by the American Petroleum Institute, addresses the problems associated with the safe and efficient transport of hazardous materials through the development of a materials transportation data base. It provides a state-of-the art examination of various inputs to the hazardous transportation file by providing the foundation for a broad based and comprehensive data base. The level of involvement by the federal government and state agencies in the field of hazardous materials transportation is documented. Methods for data development, maintenance, and dissemination at the federal and state level are identified. Plans for emergency response in the event of a hazardous material spill are outlined. The U.S. Environmental Protection Agency is the agency responsible for

monitoring the effects of a hazardous material spill on the land, air, water, or biosphere. Existing educational, training and technical programs for personnel involved in hazardous material transportation and spills cleanup are listed. Legislation and regulations concerning the transportation of hazardous materials are reviewed.
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